

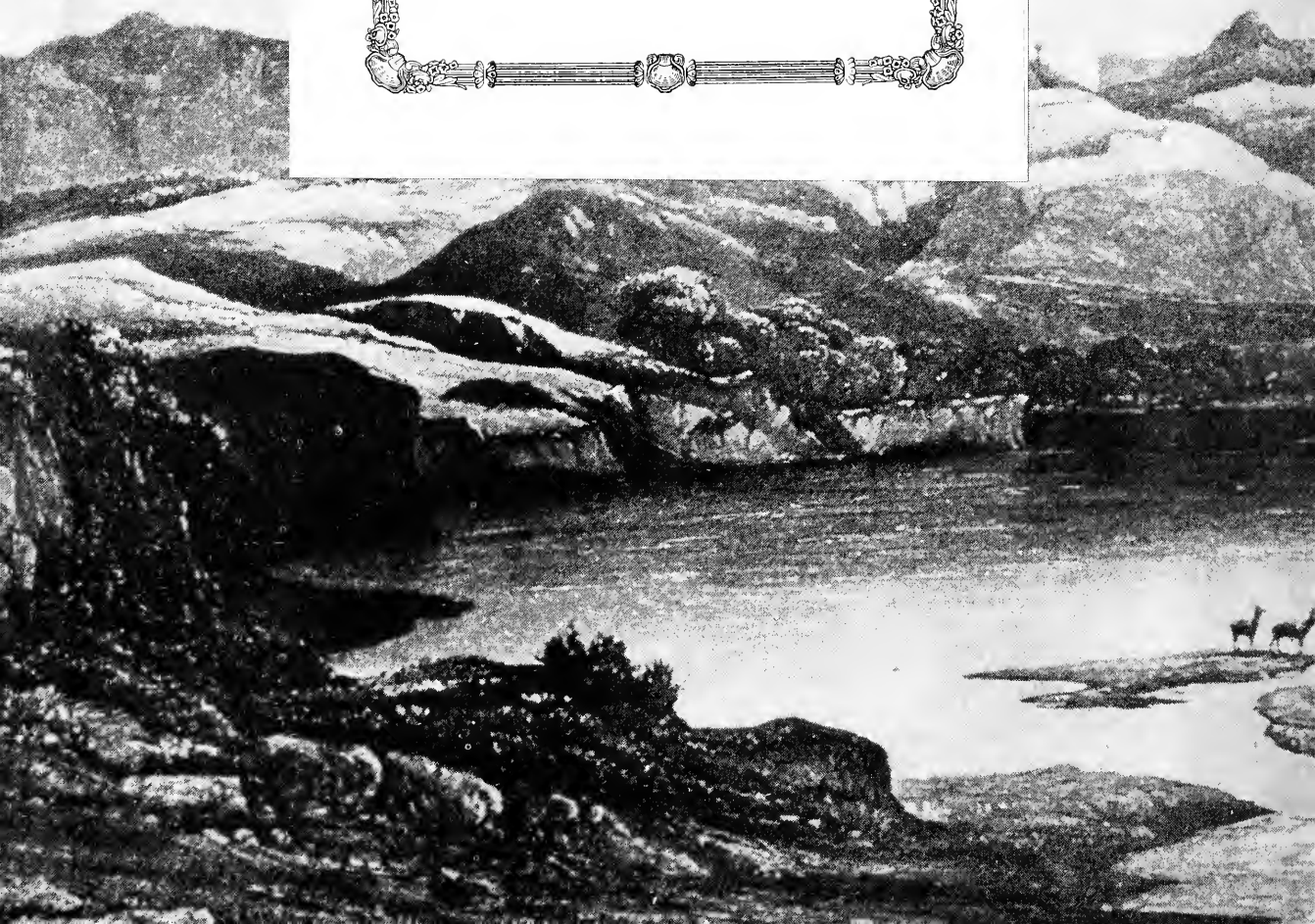


THE PRONGHORN ANTELOPE

Antelope on the upper Missouri, in July, 1833,
from a drawing by Carl Bodmer, artist with the
expedition of Maximilian, prince von Wied-Neuwied.

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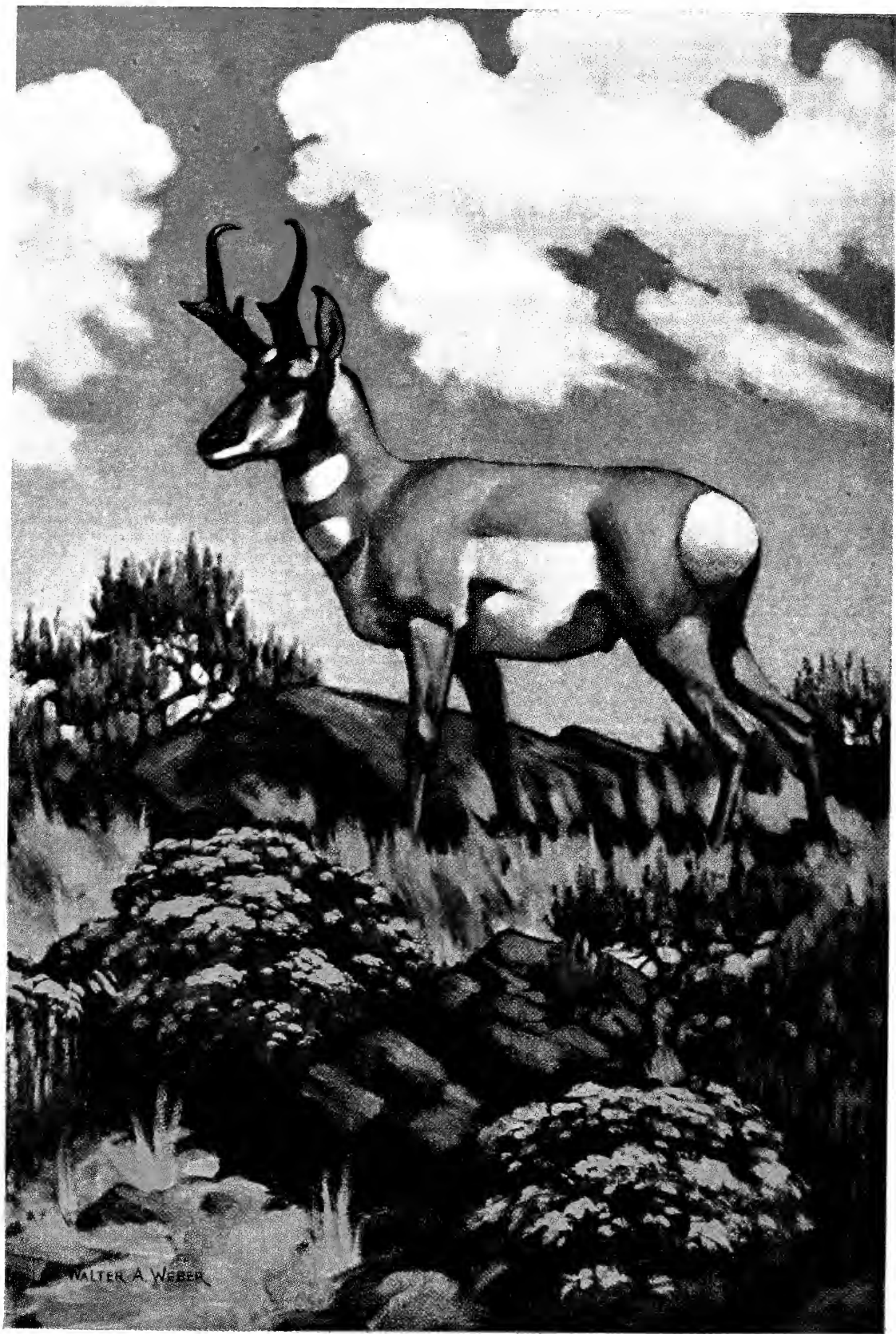


THE PRONGHORN ANTELOPE

and its management

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The Pronghorn Antelope

THE PRONGHORN ANTELOPE

and its management

by

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Leader

Oregon Cooperative Wildlife Research Unit

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Shirley Briggs

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FIRST EDITION

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Preface

“**W**HERE ROLLS THE OREGON.” SINCE THE FIRST WESTWARD surge of heavy tides of human migrations on the North American Continent, these words have stamped themselves indelibly in the memories of many. They imply vastness and far-reaching isolation. Traditionally, the word, “Oregon” connotes a frontier. Today much of central and southeastern Oregon is as primitive as when the first *vaqueros* drifted up from the California ranges. An era of land settlement began in Oregon in 1840 and extended to 1880, followed by expansion from the nuclear areas first occupied. During this era of exploitation, the wildlife resources of the state were depleted and several forms are now gone, perhaps never to return.

There are no current records of the desert bighorn. No longer does the lava bear of the Klamath region tread the outcrops, leaving his monstrous tracks in the dust of the trail. When Lewis and Clark drifted down the Columbia River in sight of numerous Indian encampments, they saw the skins of mountain goats used as articles of clothing by the Umatillas. They noted these skins although they did not account for their origin. Skeletal remains of this species have been found as far south as the caves of Mount Shasta according to Bailey, but there is no evidence that even remote mountain sections of Oregon were occupied by these goats before the arrival of the white man. On the other hand, no one will deny that the white-tailed deer once so abundant in the Willamette Valley were driven out of their habitat by white settlers, and now exist as a remnant only in a few localities.

Many wildlife species rapidly declined in numbers during the years of the early settlers. Respite came for the Oregon pronghorn in 1913. Less than a hundred years after the first settlement, it became apparent that this animal, with a larger initial population in Oregon than in many other parts of this country, would soon be exterminated if its care were neglected. It was obvious that unless an organized program were undertaken to place this resource on a sustained yield basis, the Oregon country would become as barren as other districts settled earlier by people indifferent to the fate of wildlife.

Oregon has had several evangelists of conservation, such as Dr. and Mrs. William L. Finley and Stanley G. Jewett, who preached definite wildlife programs. Each of these workers helped to pave the way for the understanding that later brought about a more extensive program of management and conservation.

Shortly after the passage of protective laws by the Oregon legislature, Ira N. Gabrielson became a field worker of the Bureau of Biological Survey in Oregon. His comprehension of the problem was complete. His enthusiasm and power to paint word pictures for others of the beauties of the out-of-doors were effective, and conservation was his theme. Under his leadership many became interested in the subject. Fortunately, a number of these men were closely allied with the educational programs of the state. Dr. George W. Peavy, ex-President of Oregon State College and Dean Emeritus of Forestry; W. M. Schoenfeld, Dean and Director of Agriculture, Oregon State College; Dexter Rice, former Chairman, and E. E. Wilson, present Chairman of the Oregon State Game Commission, and many others joined in initiating a cooperative conservation program which stressed education and management as the means of stabilizing these resources.

A strong foundation was built when the Department of Fish and Game Management was created at Oregon State

College under the able leadership of Professor R. E. Dimick, and a curriculum materialized. At the same time the Bureau of Biological Survey (later a part of the United States Fish and Wildlife Service) in cooperation with the American Wildlife Institute, began to establish wildlife research units at land grant colleges, which were to direct their activities toward urgent problems within their respective states. Among these was the Oregon Cooperative Wildlife Research Unit, established in 1935 at Oregon State College, Corvallis, Oregon. Its creation and operation were the joint effort of the U. S. Bureau of Biological Survey, the American Wildlife Institute (Wildlife Management Institute), the Oregon State College through its Agricultural Experiment Station, the Oregon State Game Commission and the Oregon Agricultural Research Foundation.

It was at this time that the pronghorns were designated as a problem species by the Oregon State Game Commission. Because of the nation-wide interest among the cooperator it was decided to carry on an intensive research program in Oregon, yet not overlook the interrelationship of other western pronghorn habitats in the final report of the undertaking. Research on the problem was started immediately, continuing from that date until now. This publication treats with the facts accumulated during this study and, therefore, shows the localized influence of the Oregon work.

Introduction

WE ARE CAMPED IN AN OLD WEATHERED CABIN KNOWN AS "The Post," high on the slopes of Hart Mountain. The site was named in remembrance of a military encampment made there in 1866 by General Crook whose duty was to control the local warring Indians. All along the little-traveled road the friendly ranchers have extended the hospitality of the outland to us; and it has been through skillful social maneuvering that we finally gaze down on the rolling tableland at the head of Guano Valley as we unpack our gear for a period of antelope study.

The bond between the naturalist and society is of wavering strength. When the out-of-doors calls, forgotten are home comforts and the daily paper. Ignored, too, are the punctual meals in the farmhouse, the choice steaks browned in butter, and the clean sheets between warm comforters on a springy bed—all powerful temptations at the end of a wearying day. Instead we shake out the old bed roll which looks more capable of turning out a good case of lumbago than a night of rest. Yet sleep comes quickly.

In the numbing cold of an early May morning we crawl from our sleeping bags and quickly stir the dying cottonwood embers in the old sandstone fireplace and light the breakfast fire in the little cracked kitchen stove. A quick trip behind the cabin to the spring and a brisk rub brings the color to our cheeks. There can be no lost motion. Breakfast with substantial food like well-egged hotcakes and bacon is a hurried, orderly procedure, and before the deep shadows have been dissipated by the morning sun we swing off down the valley for the day's observations. A little below The Post is a log cabin and as we pass by we think of the recent experience of

a woman whose husband was working temporarily in the area. She had been facing the wall as she ironed when suddenly as the bright iron flashed back and forth, she felt a sharp sting on her forefinger and glancing down in horror saw a small rattler coiled in the chink of the logs ready to strike again. We tossed off the idea with a shrug; perhaps that will never happen to us, even though we sleep on the floor, as after all our cabin is 300 feet higher on the hill and in a colder spot. Oh, yes, the lady recovered, although the 80-mile ride into town was not pleasant.

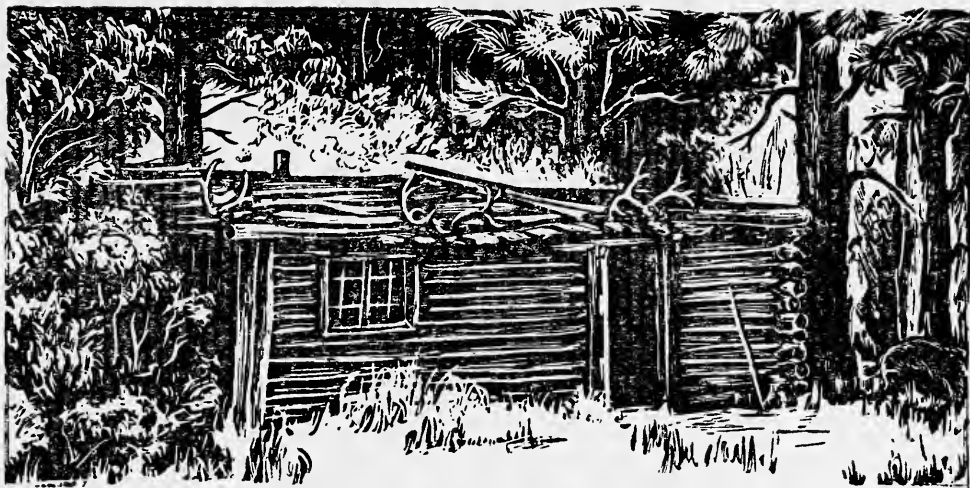
We arrive at Spanish Lake. Since the spring has been dry, the lake bed is already like a sun-baked race track and only a few green shoots emerge from the soil. The feeding pronghorns hurry over the rim to disappear in the distance and we settle ourself in the blinds prepared long ago on the sloping hillside above the lake, where we can watch the antelope on the plain and on the lake bed. The sun, which had given promise of warmth to the earth early in the day has now disappeared behind scudding clouds with fingers of mist reaching down toward the prairie. A shrill cry pierces the air and near at hand a red-tailed hawk flies by with a ground squirrel firmly gripped in his talons, heading for a favorite escarpment a short distance away. Near its base is a dead yellow pine where he alights, a favorite roosting place of the hawks, and where many an unwary ground squirrel is eaten.

The antelope kidding season is about at hand and heavily-laden does move restlessly about the range. The older ones seem more purposeful and resent intrusion by others of their kind. In quick irritation they drift off to stand in seclusion, or course back and forth across the basin, never content, and apparently knowing not what they seek. A large dog coyote, range language for male coyote, sneaks out of a canyon and works his way toward the antelope. His only interest is food and he overlooks no opportunity to satisfy his craving. He has learned to keep his distance, however, because at this time

the does are touchy and he fears their sharp hoofs. A group of yearling bucks now work toward the blind so it is probable that a few pictures can be taken and we drop to earth behind the rock shelter to await their coming. It is getting colder every moment and in spite of warm clothes our teeth begin to chatter. A cautious peek through a chink in the rock encourages us to lie down again in hope of a shot but for two hours the rascals move tantalizingly back and forth apparently unaware of our presence yet never within reach of the camera. We are not disheartened since days may elapse between satisfactory pictures.

Wildlife photography has always taxed man's skill, ingenuity and patience. Today it is no different. After a series of peeks, you may discover that five of the beautiful bucks you have been watching are rapidly coming within camera range. The threatening sky then lets go and an intensive hailstorm beats down on the prairie. Yet there may still be a chance at a good shot. The pronghorns are standing motionless with their rumps facing the storm. The sun begins to break through far to the west and the light meter in your hand shows some promise of success. The storm is moving away, the light intensity increases, and in the near distance a cat's paw of wind stirs the sage and fingers their tops as it playfully approaches your hideout. Passing over a strip of barren ground, it raises a puff of dust and a tumbleweed, which has lain inert, gradually gains momentum and rolls toward the five pronghorns. With only a moment's hesitation they dash away over the rolling rim to some unknown destination, and another chance is lost.

By now the afternoon is well along and a brisk walk to the dry lake bed partially restores circulation while we examine the fresh cropping of the sparse vegetation. We collect a sample of these plants for later microscopic studies of their cell structures. These are used to determine food preferences as indicated by percentage composition of pronghorn pellets or droppings.



"The Post"

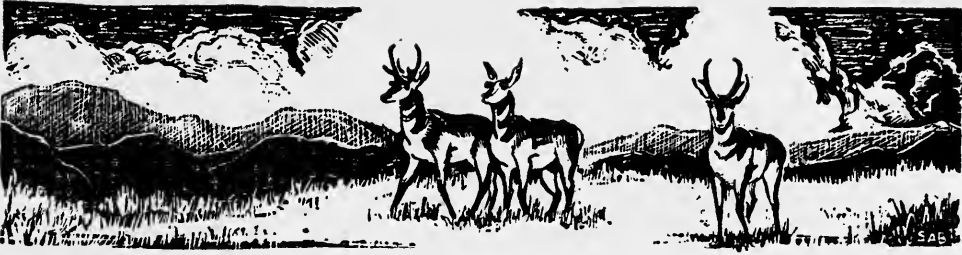
Since kids may be expected any day now and the old doe observed in the early morning may have had her kid, we swing over the range anxious for a camera study of a newborn antelope baby. The use of protective coloration in nature is well recognized. In our experience antelope kids blend so well with their surroundings that at a distance of 6 feet they may escape notice if their hiding place is well chosen. We spend an hour combing the range thoroughly but fruitlessly and in the dusk of evening we make the trek homeward with our heavy field photographic equipment. As we reach the old cabin there is no doubt of the next move. Everything must be set aside for the moment until the need of food has been satisfied. Then, when the cameras are cleaned and adjusted and the notes of the day brought up to date, we crawl into the sleeping bags as the embers in the fireplace glow cheerily.

Thus a study of such a species as the pronghorn antelope entails much observation and patient waiting. The days from March to October are long on the range and we wasted few daylight hours. We made journeys into the antelope habitat by car, afoot, horseback, and by plane. In many of the detailed studies endless repetition was necessary so that ac-

cumulated data might provide clues to the solution of vexing problems.

In this study, field work on the pronghorn antelope was conducted on the ranges of Oregon, Idaho, Nevada and California at all seasons. The initial program consisted of surveys and abundance and distribution studies. Then followed a search into the intimate life habits of the species and a study of available records of other states to learn if comparable conditions existed elsewhere and if treatment and management policies suitable to Oregon might not be beneficially applied to such ranges.

Few may feel that winter days of study on the pronghorn range could be pleasant, but I assure you it was a happy occupation. The smell of the sage and the throaty, high-pitched *ka lank* of the raven still lingers on. How dull will be the world when isolation is no more and we cannot watch these wildlings in their natural habitat. A lifetime cannot be better spent than to defer this day.



1

History, Distribution, and Abundance

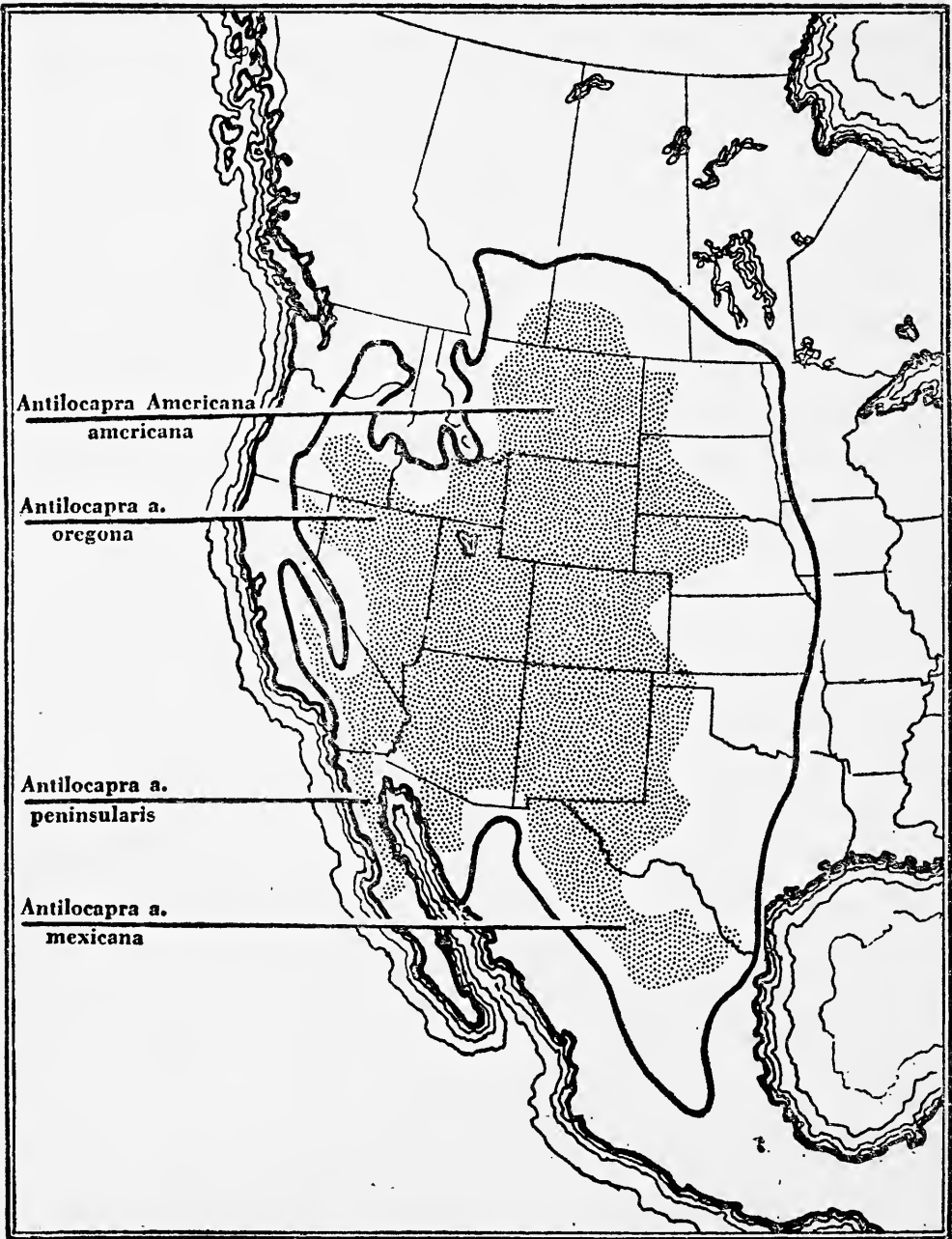
THE PRONGHORN IS NOT A TRUE ANTELOPE, BUT BELONGS to another family (the *Antilocapridae*), of which it is the sole living representative. Unlike the true antelope, the pronghorn is native to North America where a number of fossil forms have been found in rocks, which were formed some twenty millions of years ago, according to geological lore.

Pronghorn of this range differ from other hollow-horn mammals in possessing horn cores situated on the frontal bone just back of the orbits. The horny sheath covering these bony processes, which is in reality composed of hairy fibers, is shed annually. The horn cores underneath are permanent. Like the giraffe, deer, and cattle, the pronghorn is cloven-hoofed.

The past history of this interesting game animal is not yet clearly understood, but the broader features can be outlined.

Prehistoric Distribution of North American Pronghorns

Pronghorns ranged widely west of the Mississippi in Palaeozoic times. Fossilized specimens have been found in Illinois, Wisconsin, Nebraska, Arizona, California, Oregon and other western states (Hay, 1927). The better known fossil localities from which this species has been reported include Hay Springs, Nebraska; Rancho La Brea, California, and Fossil



Antelope Distribution in North America

showing type localities

shaded area indicates present normal range
heavy outline indicates greatest extent of range

Lake, Oregon. The Nebraska fossils appear to have lived several hundreds of thousands of years ago, while the last two are not more than a few tens of thousands of years old.

Although the fossil remains show considerable similarity in form, there were great differences in size and horn structures. Some had four horns and others had single horn cores but with two or more branches or prongs.

Several pronghorns now extinct were also living in the Great Basin Province during the Ice Age. For a time, geologists considered one of these to be a possible direct ancestor of our present form, and it appears possible that the one species still occupies its center of origin.

The fossils already found and studied show changes in form, although there is no simple sequence which determines the successive evolutionary steps enlightening us on the time of origin of the prevalent species. It appears probable that these changes took place within what is now the Great Basin Province, under varying climatic conditions which, at times at least, were more humid than now.

Thus it appears that the pronghorn prehistorically occupied the western United States. It is still distributed over most of this area in varying densities. After millions of years it now remains in Oregon in suitable habitat areas, but in the memory of man has always been considered a remnant species. It is truly native and chooses for its range some of the most unproductive lands of the state. After having survived through the æons of time since it first roamed the wastelands, it would be tragic to have it exterminated in the first century of human custodianship.

Historic Records of Pronghorns

The elusiveness of the pronghorn on its native ranges is reflected in the history of its occupancy on the North American Continent. It has been mentioned sketchily in the notes of various exploratory commissions, hunters and

trappers. Most of these records are indefinite and confusing because pronghorns are referred to by local names that obscure the identity of the animal. Further uncertainty is added by attributing to them habits common to other species. Since few of these observers were naturalists, their references are not sufficiently complete from a scientific standpoint.

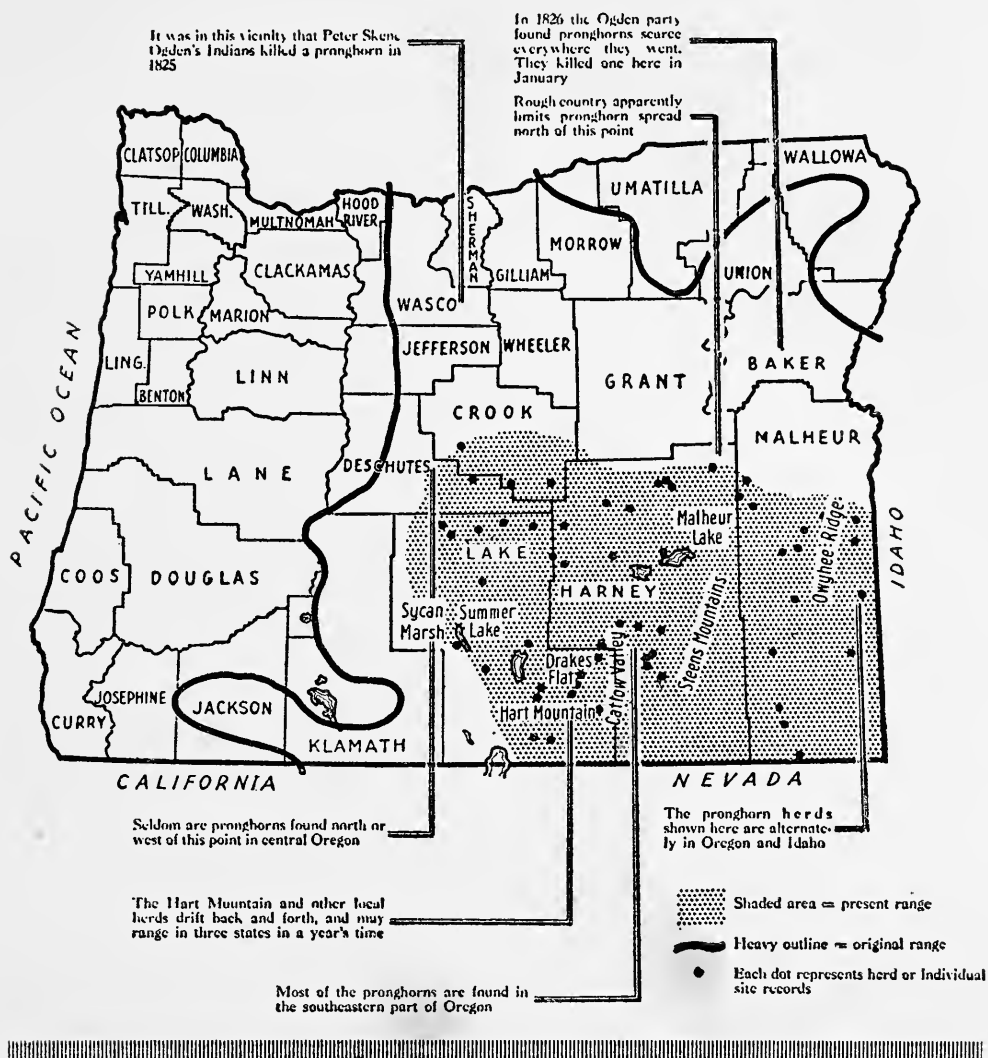
Spanish explorers localized the pronghorn to the Southwest. In Oregon the earliest records are found in *The Journals of Lewis and Clark* (Hosmer) which describe the antelope native to the Columbia plain. Although the reference is not specific, it implies that this species inhabited the rolling hills of the Columbia, but no mention is made of great numbers, perhaps because the country was occupied by Indians. Undoubtedly, under their continuous persecution, such a nervous animal as the antelope would be driven to the more remote hunting grounds of the red men.

There is much to be learned about game distribution from the records of the early explorers. Contrary to popular belief, game was not always abundant. Reuben Gold Thwaites, writing of early western travels, repeats the comment of John B. Wyeth as follows:

"This may serve to show among other things, how ill-informed Captain Wyeth (Nathaniel)and his company were of the true condition (of the country) through which they had to pass. We expected to support ourselves with game. . . We were informed at St. Louis that it would be necessary to take oxen and sheep to be slaughtered on the route (up the Missouri and Platte) for our support."

The report continues that they did this, and found full justification for the course in the scarcity of all game along their route. They rarely saw pronghorns. This expedition was in 1832, when one would suppose the river valleys to be teeming with game.

Unfortunately, most of the records of pronghorn abundance are based upon estimate. Greenwalt (1932) says that historians estimated their number at approximately 50



million animals at the time of the first buffalo hunters. There is little to suggest that such great herds ever occupied the territory that is now the State of Oregon, which was typical Indian country. Several large Indian tribes were definitely established in range suitable to antelope. The southeast portion of the state was inhabited by the Snake and Bannock tribes, which drifted into the high country from the Snake River basin and worked their way into the rolling plateaus of the Owyhee and farther west. It is true that before the white man came their hunting methods were primitive, but where, in this vast stretch of country which continually felt the

tread of hungry people, could great antelope concentrations exist? Perhaps before the infiltration of the Indian tribes, but no evidence of abundances in prehistoric times has been discovered. In the early 1930's, when Malheur Lake receded to an all time low, numerous bison skeletons were exposed, but antelope bones were rare in comparison.

Further proof that antelope were scarce in central and southeastern Oregon is found in the records of anthropologists. Cressman (1940) mentions the scarcity of leather in the dress of central Oregon Indians, as follows: "Among more than 3,000 articles dug up in Catlow Valley caves and to the west, there are but two pieces of costume, both moccasins, made of leather. These undoubtedly were left by a later roving party. . . . Many sandals made from shredded sagebrush bark and grasses were found and what appears to have been a short blanket, also made from shredded sagebrush bark. The absence of hide in any form of clothing is a striking characteristic of the prehistoric people of this region. Leather was never there or it would have been preserved as even the more fragile specimens of string nets and basketry." It is a simple deduction that if antelope or other animals with suitable skins were plentiful, leather would surely have appeared in their costumes.

Peter Skene Ogden,¹ in the early part of the last century, reported antelope to be scarce on central Oregon ranges, where today there are evidently far more of them, despite changed economy. Ogden's Journals, covering his experiences in 1825 and 1826, tell of an antelope killed by an Indian south of the present city of The Dalles, probably north of Maupin or in the rolling hills east of the Tygh Valley. Ogden's party worked southward, and eastward. He comments on the scarcity of game and reports the kill of a second pronghorn in the south end of the Blue Mountains near Burnt River, on January 26, 1826. On November 12, 1826,

¹cf. *Oregon Historical Quarterly*, 1934.

they saw two herds near Malheur Lake, where antelope are still found. Detailed information about antelope between this period and the arrival of the first settlers in the antelope regions of Oregon is lacking.

Antelope are the phantoms of the prairie and much that has been said or written about them has a preternatural tinge. It is an elusive animal and therefore must have been an undependable source of food to the trappers and explorers, whose interest in wildlife was wholly from this standpoint. They had no time for the kind of hunting that required skillful stalking, except when their very existence was at stake.

The Indians also found the pronghorns undependable as a source of food, and would ordinarily take them only under two conditions: when they found them in such abundance that the "surround" or stampede methods was effective (whereby they could kill great numbers at one time), or when their customary food, live rodents, had been reduced to a remnant. Then hunters would continually stalk the pronghorn but usually with little success. There is proof of this in the incessant vigil at the waterholes and springs in the desert. Still present are the rock blinds from which the Indian shot his crude shafts. These blinds are today frequented by trophy hunters who in the dust of the desert find numerous arrowheads—the missed shots of the Indians.

Perhaps this is one of the reasons why small herds survived, scattered over the United States at the end of the pioneering period. The only bison left were those that had received protection through their isolation, or because of human intervention. At no time has the antelope been driven from its original range, being continuously represented by a few individuals in widely scattered sections of the plains country. About the middle of the nineteenth century, the Piutes of south-central Oregon found themselves facing starvation when a scarcity of rodents, their main food supply, failed presumably as a result of their own persistent

hunting, or of a cycle of scarcity among the rodents, or of disease. Whatever the cause, the Indians began to hunt antelope aggressively, and those animals that escaped became so wary as rarely to present a target, even when stalked by the most skillful Indians. They tempted the hunter or the trapper but little, since he gained only fleeting glimpses of the scattered remnants in the far distance.

Abundance of Pronghorns

Unfortunately, the technique of measuring wildlife abundance is in its initial stages. In trying to determine relative antelope abundance over a long period of time we can only resort to well-founded reports, or make estimates based upon the best information available. It has been necessary to reconstruct the history of Oregon herds in this manner. There seems to be little real knowledge of their range or numbers, except that they were either said to be abundant or scarce as a food supply. Very little is known about the antelope herds before the coming of the settlers into southeastern Oregon in the seventies and eighties. There are many residents still living or recently deceased who settled in the area at that time and who as boys hunted antelope and watched them enough to estimate their numbers. One of these was the late Oliver Jacobs, who settled in the Guano Valley in 1886. Jacobs spent much of his boyhood hunting deer and antelope in that range and later rode as a cowboy for many years. He believed that in 1939 antelope were more abundant in southeastern Oregon than at any time since the coming of the settlers.

The history of wildlife in Lake County is more complete than that of the other part of Oregon, because it was explored and settled early. It is generally reported that antelope herds have existed on the ranges of Hart Mountain, Guano Creek, Drake's Flat, Catlow Valley and around Beatty's Butte from the time the first white settlers or explorers

passed through that country. According to reports, the Drake's Flats herd was at one time reduced to about 10 animals. They were so wary that it was almost impossible to kill one. There was a gradual increase which seemed insignificant, so few were the animals. Even after antelope hunting was prohibited by a law which the Oregon legislature passed in 1913, the increase was not rapid. Not until about 1925, when public interest in antelope conservation was aroused, and better protection was afforded, did increases in the herd become more noticeable. And by 1938, there were estimated to be 2,500 antelope on Drake's Flat.

This is an excellent example of the effect of one phase of wildlife management—protection. It is one of the best ways in which the general public can help conservation. It will overcome many of the problems of game deficiency, but does not ordinarily constitute the entire management program; for complete prohibition of antelope kill under certain conditions may be as detrimental as beneficial.

Nevertheless, an increase of pronghorns from a mere handful to a herd of over 2,000 animals in 25 or 30 years justifies the procedure as a means of restoring the antelope to a population which seems secure against extermination. It suggests also that it is necessary to measure progress in long periods of time. In this case nearly half a normal life span was consumed in this program. Many conservation problems may not be solved in a human lifetime.

The first careful pronghorn survey of record is that of (Bailey, 1936, p. 72) Stanley G. Jewett in 1915. This was followed by additional surveys by Jewett and E. W. Nelson (1925) from 1922 to 1924, and by various others until 1937, during the period when increases were obvious. The following are estimates or census figures available up to the time the Oregon Cooperative Wildlife Research Unit was assigned the problem and inventories could be made on a systematic basis.

Estimated Pronghorn Abundance

<i>Year</i>	<i>Number</i>	<i>Area</i>
1913	2,000	Hart Mt.—Warner Valley
1915	1,840	All pronghorn habitat of state
1922	2,000	Southeastern Oregon
1925	2,039	Southeastern Oregon
1935	20-25,000	All occupied pronghorn habitat of state

Active field work was undertaken by the Research Unit in February, 1936. In early spring workers were stationed in the pronghorn habitat, and by fall, location and abundance of individual herds were known. Until these workers became familiar with the periodic drift of the pronghorn antelope, there was a tendency to overestimate abundance, but these figures were still far below the popular estimates.

Census figures of the Research Unit were obtained after complete surveys of occupied ranges. This task began in 1936 but it was almost a year before a state-wide census could be completed. Afterward, inventory of the same areas was made annually when possible. In 1944, in addition to the ground census, 60 hours were spent on aerial surveys over the more inaccessible regions. The figures in Table 1 are believed to be a reliable count of Oregon pronghorn populations, and sufficiently accurate to be used as a basis for a future management program.

Popular estimates of pronghorn abundance among persons familiar with their range were inclined to be very liberal. In 1936, at the beginning of the study, many riders, ranchers, and field personnel were interviewed. Before herd distribution had been determined, a tabulation of these estimates indicated a population of about 20,000 pronghorn antelope. In 1944, following a gradual recession in numbers, there were common reports that the antelope numbered 30,000. Unfortunately, it is this type of optimistic gossip that forms the foundation of demands by hunters for liberal harvests.

TABLE 1.

Pronghorn Census in Oregon Pronghorn Habitat

Oregon Cooperative Wildlife Research Unit. 1937-45, inclusive*

Year	Number
1937 -----	17,000
1938 -----	18,115
1939 -----	19,205
1940 -----	18,240
1942 -----	16,900
1943 -----	14,210
1944 -----	12,900
1945 -----	9,670

*Because of other assignments a 1941 census was not completed.

Field work and local conditions leave little doubt that the pronghorn herds of Oregon are decreasing. Between 1942 and 1945, the national restrictions on meat affected Oregon ranges indirectly. Grazing lands for domestic animals were in great demand, and because of marketing quotas, larger herds were maintained on some ranges than ever before. Under these conditions, complaints from pronghorn depredations almost disappeared. On one sheep range, where antagonism to pronghorns persisted, no complaints were voiced. The reason lies in the scarcity of antelope. The numerous complaints in previous years were justified in many areas, and for this reason the Oregon State Game Commission continued to allow a liberal harvest. The species now requires additional protection, including a program, of redistribution based upon habitat requirement.

Migration or Drift

Migration implies an orderly seasonal movement of animals from one region to another. Among mammals, the Alaskan caribou perform regular migrations. By these standards Oregon antelope cannot be classed as migratory animals, although authors often write of their "migrations." They

may change feeding grounds several times within the year, but their drift from one range to another is not usually a long trek, lacks rhythm and will as often be northward as southward in winter. They may also change elevation at any time, although the does with kids usually remain on the lower levels while the kids are growing. During the months of extreme cold weather, Catlow Valley antelope may rapidly work their way to the topmost slope of the Hart Mountain Range, where on windswept ridges they will feed and stay for long periods in temperatures far below zero. One herd will come from the lower range on Crowley Flats and wend its way to Anderson Valley, a high basin on the north end of the Steens Mountains; and if deep snows do not fall, may winter there. Catlow Valley herds may be replaced by antelope drifting up from Guano Creek and the northern part of Nevada at a time when it is popularly supposed that there is a definite migration southward. This redistribution is not at regular intervals.

Changes in habitat may result from the loss of a water supply, unfavorable weather conditions, molestation or numerous other causes. The Hart Mountain Refuge, created primarily for pronghorns, was established with the knowledge that its water supply would draw the herds from the parched range lands. As long as pronghorns roam the sage, the water of Hart Mountain will lure them; and they may come from the south in a warm autumn as often as from the north. The selection of feeding grounds clearly lacks the orderliness of a well-defined migration.

Antelope distribution may be influenced by the type of terrain. Eroded ground of the "badlands" type apparently acts as a barrier as effectively as heavy timber stands. Pronghorns in Malheur County, south and west of Harper, have not penetrated usable habitat north of a heavily eroded area, but have followed its fringe to occupy inferior ranges farther north.

Obviously, molestation is an increasing factor influencing

the choice of habitat areas. The antelope characteristically avoid sheep bands and are usually successful in seeking out unoccupied ranges, except at kidding time.

Range occupancy may be limited, too, by the direct actions of man. The use by the War Department of vast stretches of antelope range east of Hart Mountain to the Steens and from the Steens to the Owyhee River since 1943 undoubtedly caused some pronghorn redistribution which, however, could hardly be called a migration.

Daily flights of planes on aerial gunnery practice maneuvers at elevations of from 1,000 to 10,000 feet, seemed to frighten the animals away from ranges they had long occupied. The influence on the selection of kidding range by doe antelope in the spring of 1944 was obvious. Plane flight courses were from Lakeview, Oregon, to Boise, Idaho, and at several points along the route passed over communal kidding ground used annually since our observations began in 1936. In 1944, Spanish Lake and Catlow Valley kidding grounds were almost forsaken while the Charles Sheldon Refuge area in northern Nevada, less than 40 miles south but well off the course, was well stocked by does at kidding time. It has been argued that perhaps the occasional burst of gunfire, of which there was tangible evidence, loosed by curious gunners against the rimrock in several instances, may have had a direct effect upon antelope reactions. It has been observed that more remote influences will frighten wildlife. One of my first experiences with planes and wildlife was in 1933 about the time that mail planes established regular routes and schedules from San Francisco to Seattle. In January and February following the hunting season, great concentrations of ducks and geese would gather in the Sacramento Valley near Willows and Maxwell. We could accurately predict the arrival time of the mail planes because two to three minutes before these low flying ships hove into sight, the geese would all rise ponderously, fly over to the edge of the valley well away from the plane route to wait

until the plane had passed. They would then return and perhaps settle down on the very spot they had left. This occurred daily.

Animal response to vibrations and electrical impulses is a little understood phenomena. Here the human ear and eye failed to recognize some impulse that was commonly registered by the geese. Persistent attempts to detect how they sensed the approaching craft failed, with the conclusion that man's knowledge of nature is of the sketchiest framework. I shall not even attempt a learned discussion to explain the influence of the warplanes on the behavior of the pronghorns. It is enough to report that along their common route the planes obviously affected range occupancy, and pronghorn concentrations there were uncommon.

The customary heavy infiltrations into the Guano Valley, Spanish and Desert Lake areas and Hart Mountain slopes did not occur, while to the south and east on the Charles Sheldon Refuge in northern Nevada, on territory outside the gunnery range, the doe pronghorn concentration was larger than usual.

Under these conditions, adjacent areas long occupied by small herds became heavily populated. This has occurred in the northern counties of California during the past several years. Modoc and Lassen Counties, particularly, felt the pressure from the Oregon and Nevada herds. Reports of redistribution¹ are apparently substantiated by a study of the following California census records:

<i>County</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Modoc	656	1,103	1,167
Lassen	3,050	3,962	4,504
Siskiyou	37 ²	273	305

¹(McLean, 1944, p. 237).

²Gordon True says: "Siskiyou County, 37 There was evidence that the Siskiyou herds should be listed at 200 rather than 37." Pittman-Robertson Quarterly, vol. 2, no. 3, July, 1942, p. 138. The Pittman-Robertson Quarterly is accepted herein as a source of factual information in its preliminary form. Appreciating that greater details are contained in

In spite of hunting seasons in 1942 and 1943, there was a pronghorn increase of close to 50 per cent in Lassen County during the years 1942-44; and Modoc County, during the same period showed an obvious decrease of both adult and kid pronghorns. No annual increases comparable to those in California were evident in the 25-year period from 1913 to 1938 in Oregon under full protection, when the remnant herd of probably less than 2,000 pronghorns in the entire state gradually increased to approximately 17,000. Supporting this is the knowledge of similar redistributions of pronghorns along the Idaho-Oregon boundary.

E. R. Sans, superintendent of the Charles Sheldon National Antelope Refuge in Nevada, in 1925¹ reported such a migration or drift from the south to the north as follows:

"The bunch at Last Chance (Nevada), where we took the fawns last year, generally leave the Plateau country about the last of November and work both ways, north and south, part of them going down into Guano Valley along the Oregon border and, I believe, crossing into Oregon. . . ."

It was reported on page 26 of the same bulletin that the herd of pronghorns occupying Lassen County, California, in 1924 "have migrated across the line into Nevada and in July, 1924, not over a dozen were sighted on their old grounds in Lassen County, although some 500 are reported ranging in the neighboring part of northwestern Nevada."

Thus the drift or "migration" has a definite effect on the survival of the species. If the four states of California, Nevada, Idaho, and Oregon recognize the interrelationship of their pronghorn herds and make proper allowances for management, optimum numbers can be maintained. But if

¹"Status of the Pronghorned Antelope," 1922-24, United States Department of Agriculture Bulletin 1346, page 18.

the original reports, research workers are referred to each state mentioned. Privilege for citing records or comments was granted the author by these states.

inventories are conducted within state boundaries and the wandering tendencies on ranges separated only by imaginary lines are ignored, rapid decreases in numbers will result. Joint surveys in all four states at the same period of the year will be the most accurate method of determining management procedures. All states that have a similar interchange of pronghorn herds should follow a conservation plan of harvest and joint management.

Hunting may also cause a change in habitat, suggesting that management by controlled hunts, with restrictions on mass activity and wholesale molestations is advisable if herds are to be maintained on available range. Yet so far, hunting has been one of the poorest techniques by which to achieve herd redistribution in desired locations.

Antelope survival hinges on a knowledge of their daily habits. This knowledge can be gained only by field workers assigned to the area and giving full time to the job. If management personnel can be permitted undivided time to concentrate on year-round study of these animals, they will ultimately understand the drift of herds and the condition of them. Unfortunately, absentee or uncoordinated management has been responsible to a large degree for the extirpation of pronghorns from vast stretches of suitable range. And no other game form can take their place.

The occasional protection offered by an itinerant field patrol cannot be effectively substituted for continued surveillance of animals whose range is as extended as that of the Oregon antelope. Frequently herds pass out of the territory allotted to the patrolman. From then on their actions are unknown to him, and false impressions may result in management errors. Pronghorn habitat studies and herd observations are a year-round necessity. Recreational returns can be self-sustaining. This fact is often overlooked by an optimistic public not inclined to count the cost while enthusiastically relying on programs of artificial restoration.

Spread of Antelope

Only in the last two decades have the pronghorn herds in the western United States been studied with a definite management purpose. With few exceptions, earlier studies emphasized the sport of hunting the animal, or the colorful habits or characteristics of it. When biologists began to accumulate facts about the distribution of the species in the Dakotas, Arizona, Texas, New Mexico and elsewhere, they found that small herds remained here and there, but that in only a few cases had they spread to adjacent areas. Records of such spread were the exception rather than the rule.

The limited distribution of the fossil remains is conclusive enough to indicate the pronghorn to be an animal of circumscribed habitat even in prehistoric days. In Oregon we have proof of its slow spread and find that even when conditions are satisfactory antelope seldom re-occupy abandoned range, even when fully protected.

Perhaps the best example is found in the Klamath basin. An article in *The Oregonian* in 1886 under the title, *Game Abounds in Southwest Oregon*, contains the following statement, "Antelopes have been driven from the level country of Klamath basin. In 1858, antelope were abundant through Klamath basin." Only a narrow strip of timber of the open pine type separates Klamath basin from Sycan Marsh where pronghorns have persisted since the coming of the homesteader. Despite a complete cessation of antelope hunting, which began in 1913 and continued for 25 years, during which time they could have found their way back to this range had they been so inclined, no recent records have been reported of antelope reaching the flat country of the Klamath Lake region or adjacent areas. This is not an isolated example. Whenever pronghorns have been driven or removed from a range, their natural return is very slow. In fact, they are inclined to take up habitat which may offer them sanctuary

but which in many essentials differs greatly in character from ranges previously occupied. As early as 1887, antelope were so heavily persecuted on the plains adjoining the boundaries of Yellowstone Park that it was necessary to drive them back into the more rugged lands of the reservation for their protection. They have now learned to adjust themselves to a habitat normally suited to mule deer and it is doubtful that, even with complete protection, they would spread naturally to more suitable range on the plains nearby.

From such experiences biologists and game managers have concluded that a program which depends on the natural spread of pronghorn to ranges in need of stocking is not effective. Measures which have proved more successful in accomplishing a redistribution or spread will be discussed later.

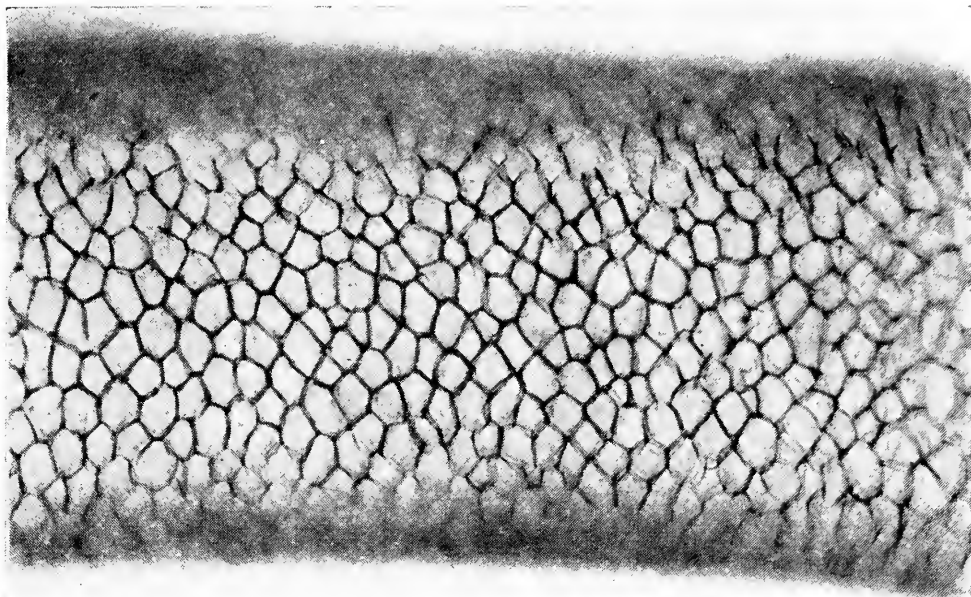


Figure 1. A micro-photograph of an antelope hair, showing reticulated surface structure. 250X. Photograph by J. C. Garman.

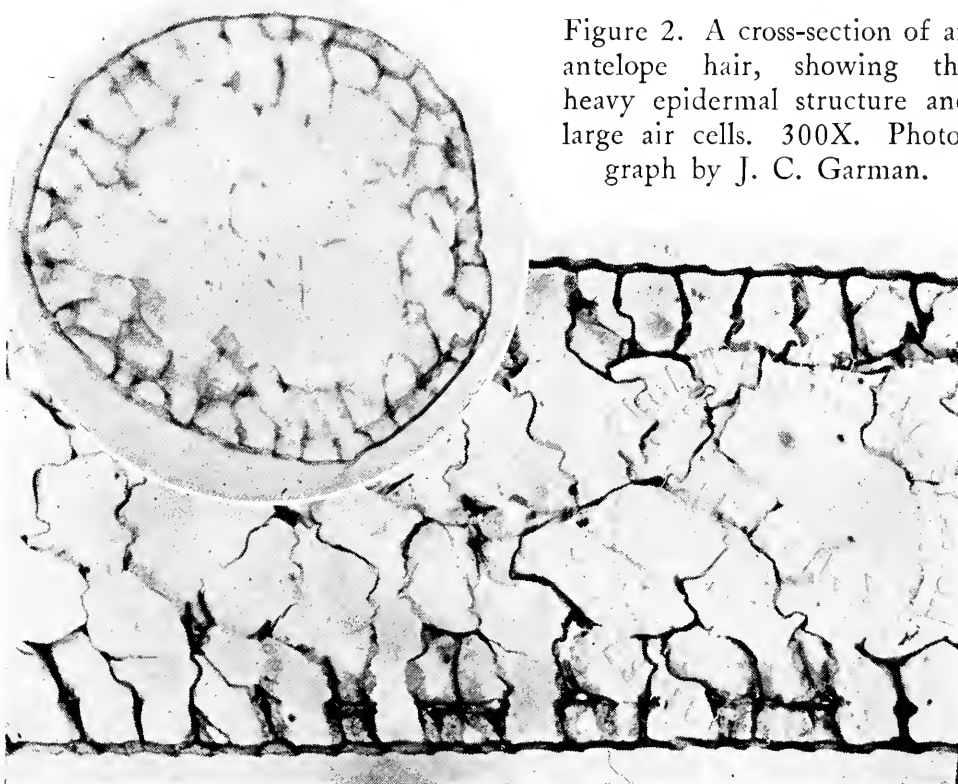


Figure 2. A cross-section of an antelope hair, showing the heavy epidermal structure and large air cells. 300X. Photograph by J. C. Garman.

Figure 3. A longitudinal section of a pronghorn hair, giving greater detail of the tough outer wall and the air cells within. 250X. Photograph by J. C. Garman.



Figure 4. Pronghorn pelage, showing tendency to separate when flexed.
Photograph by author.



Figure 5. A close-up of pronghorn pelt, showing how hair separates when flexed. Photograph by author.



Figure 6. Typical horn development on a pronghorn buck in midspring, showing hairy composition. Photograph by author.



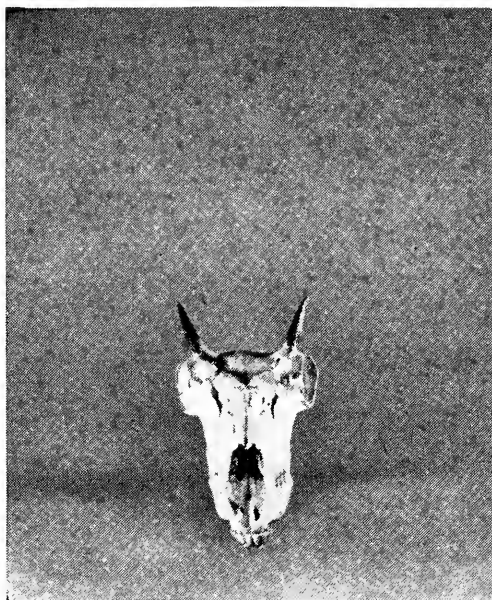
Figure 7. The light-colored horn tips and the developing horns of a young pronghorn in spring. Photograph by author.



A



B

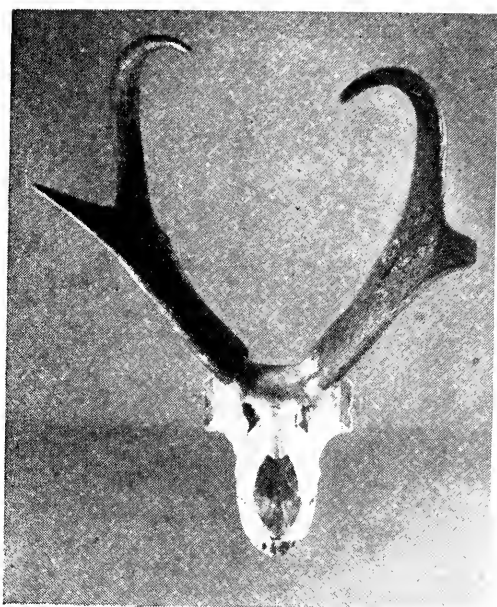


C



D

Figure 8. A. Male, Sheldon Refuge, February 10, 1942. B. Belle Fourche Valley, Wyoming, 1893. C. Immature female. Sheldon Refuge, December 11, 1944. D. Female. Mt. Warner, Oregon, September 22, 1914. Specimens from the National Museum, Washington, D. C. Photographs by Shirley Briggs.



A



B



C



D

Figure 9. A. Male. Hart Mountain, Oregon, October 13, 1941. B. Male. Sheldon Refuge, April 13, 1942. C. Forbes, N. D., 1885. D. Male. Arizona. Specimens from the National Museum, Washington, D. C. Photographs by Shirley Briggs.

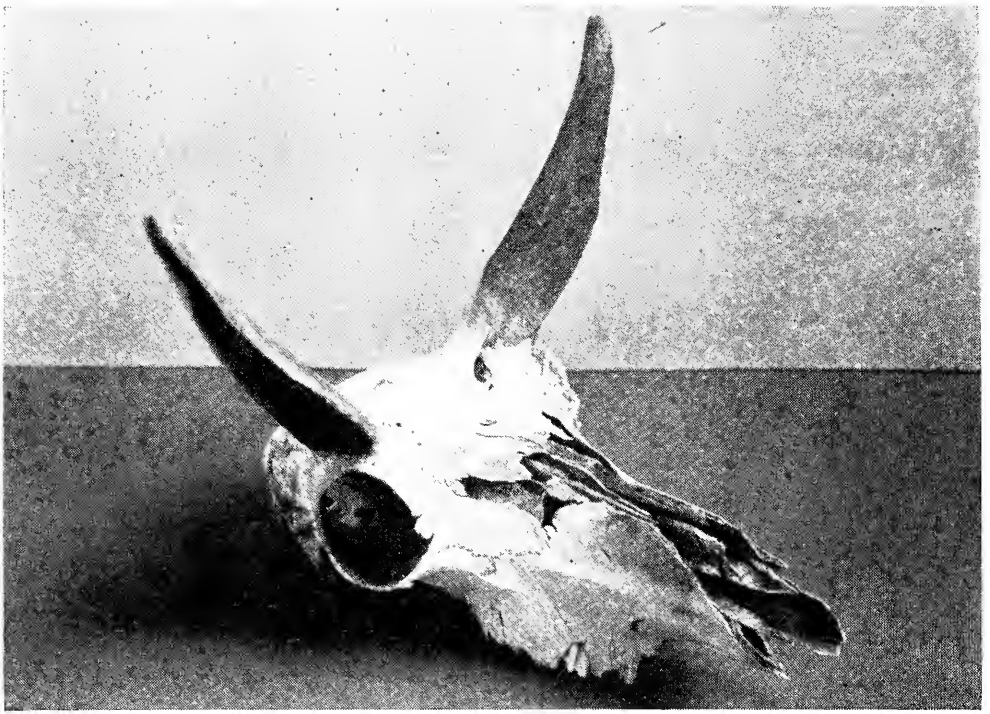


Figure 10. Large and protruding orbit of the pronghorn. Photograph by J. C. Garman.



Figure 11. Smooth horn cores of the pronghorn. Photograph by Shirley Briggs.



Figure 12. A most symmetrical set of horns. Photograph by John McKean.



Figure 13. A set of horns with horn tips bent forward. Photograph by author.

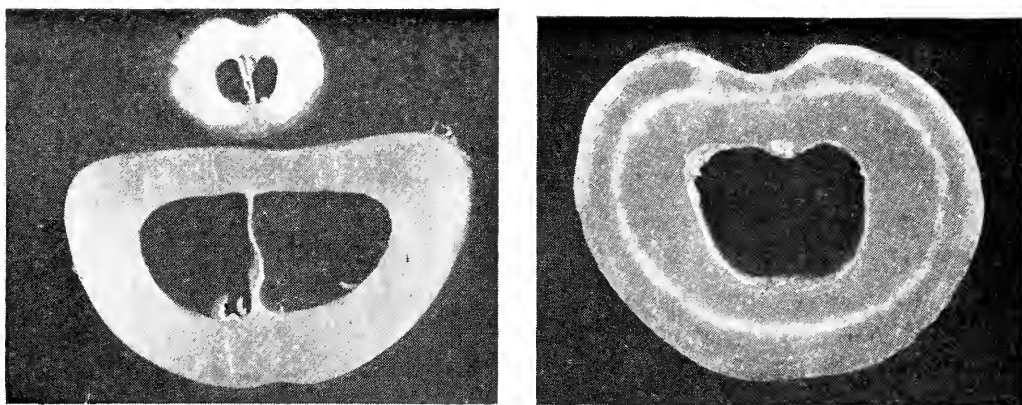


Figure 14. Left: Cross-section views of cow and pronghorn metacarpal bones. 2X. Right: Cross-section of a pronghorn metacarpus showing peripheral reinforcing and close-grained texture. Photographs by J. C. Garman.

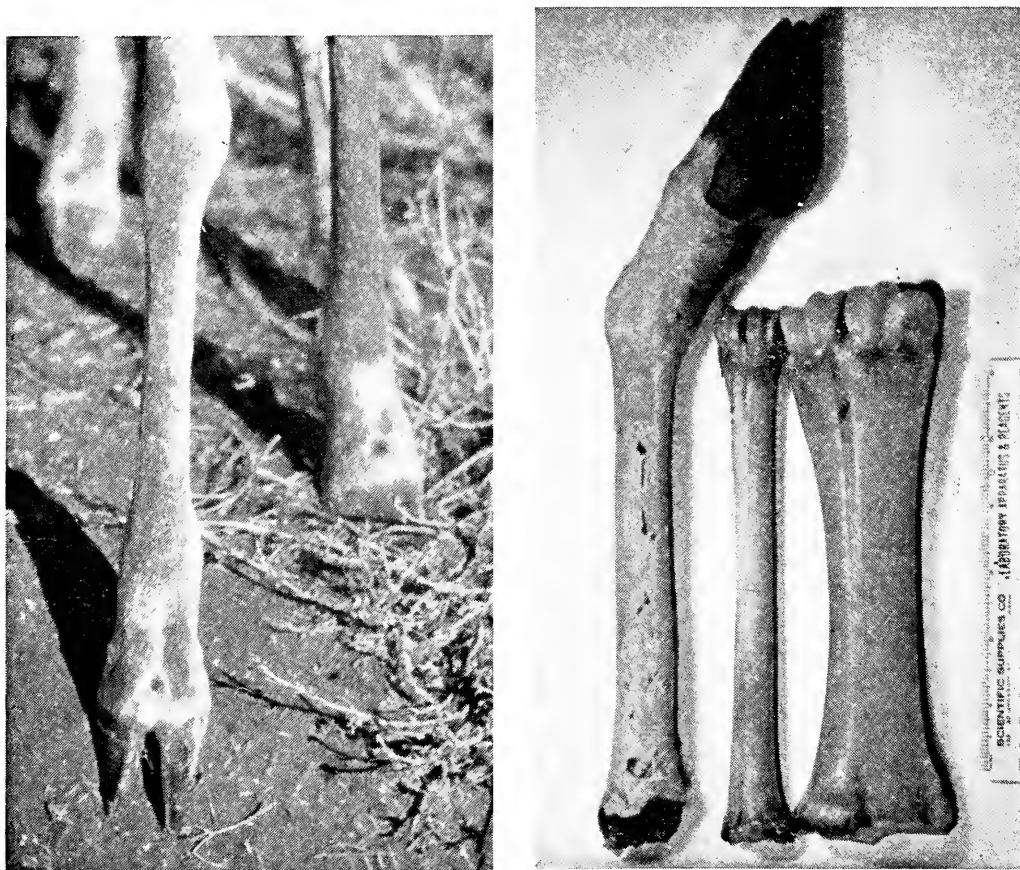


Figure 15. Left: Showing the sharp, deeply cleft hoof of the pronghorn, used for digging. Dark spots above cleft of hoofs are outlets of interdigital glands. Right: Leg bones of a pronghorn adult and a mature cow, almost identical in length but greatly dissimilar in cross section ($\frac{1}{2}$ natural size). Photograph by author.



2

Characteristics and Life History

Physical Characteristics

Pelage

ANTELOPE HAVE COATS OF TRUE HAIR, EACH STRAND PITHY and containing large air cells. This is most important in protecting them from the extremes of both heat and cold to which they are exposed. Most animals living in such conditions have guard hair and then a fine underfur. Mention is often made (for example, Skinner, 1922) of the fur or fine undercoating of *Antilocapra americana*. In *A. oregona* the fur is scattered among the coarse hairs of the pelage and is of little significance as a protection against heat or cold. It is wool-like in composition, but so fine and sparse that it is difficult to see except on closest inspection.

By means of its hollow hair the animal is effectively protected from either heat or cold in another manner. By flexing certain muscles, which are attached to the skin by tissue, the pronghorn antelope maintains its pelage at a definite angle. The hairs may lie smooth and flat, each overlapping the other like insulating shingles, to exclude the cold air. Or to keep cool in the desert sun, each hair may be erected to allow any movement of air to cool the skin.

This phenomenon can be observed by holding a pelt in the hands. The hair separates or lies close to the skin, according to the manner in which it is flexed. The intricate attachment of the skin to the body, a highly specialized arrangement, makes this possible.

By these two adjustments, antelope may live in the hottest desert areas with a minimum of discomfort, or seek out the exposed regions of the high desert plateaus where temperatures fall as low as 50° F., below zero, where they will be found feeding calmly and apparently indifferent to the fiercest blasts of frigid air. When not feeding they take up sheltered positions.

The difficulty encountered when preparing antelope hairs to be microphotographed is an indication of their insulating quality. Dr. Ernst J. Dornfeld, assistant professor of zoology at Oregon State College, cut the hairs in short segments about one-half inch long, then soaked them in xylol for 48 hours. The enclosed air in the cells was not displaced by that time. They were then placed in a low water vacuum about an hour, and no air was displaced. A Cenco high vacuum pump was used for 12 hours, then a high vacuum dessicator for 24 hours, after which the hair was warmed for 1 hour, and high vacuumed again for 6 hours. Some hairs sank, indicating that air was partially displaced. They were then transferred to a warming plate (50 degrees C) for one week, which displaced more air and by that time enough hairs had submerged to collect and infiltrate with paraffin. While embedded in paraffin they were sectioned transversely and longitudinally at 10 microns, using dry ice vapors to further harden the paraffin. It is obvious that their hair is effective in protecting the antelope either from heat or cold.

The hairs on the rump-patch are creamy white and in adults often 3 inches long. The longest fawn-colored hairs making up the predominating color patterns on the animal are from 1½ to 2 inches long.

The usual descriptions of the use of the rump-patch or

rosette hairs as a signaling device fail to describe the erectile nature of the body hair of the pronghorn. The back hair ordinarily lies smooth, and the tail, of contrasting cinnamon brown, lies snugly in a groove, and covers an area of short white hair. It is flanked on either side by the long lemon-white hairs of the rosette. When aroused, the pronghorn may twitch its skin and erect most of its dorsal hairs or only the mane. When excessively disturbed, it opens the rosette much like a fan, forming a flange extending fully 3 inches beyond the normal contours of the body. There are few animals as adept in effective displays. They also accompany this display with special gaits. A buck with hair erect, stalking stiff-legged toward an adversary looks truly formidable.

There are also a few fine, black-tipped hairs on the back and mane of the buck, which are 3 to 4 inches long, and displayed under such emotions as anger or fear. Pronghorn bucks are the Beau Brummels of the desert, and use these back and mane hairs to advantage in posing. Both sexes among the kids do this at an early age but especially the males. There is something very like our own play-acting in the way the males seem consciously to choose conspicuous places and affect striking and appealing positions. Whatever the purpose, the long black hairs on the bucks are an important part of the pronghorn's wardrobe. The black mask of the buck covers his face up to his horns. The doe's nose is very black, but only a faint shadow of dark hair extends upward on her face.

Antelope pelage is of poor quality and the hairs are continually being shed, although the most rapid change from winter to summer coat occurs from March to May. In Oregon the new coats are usually at their prime by mid-July.

Because of the loose attachment of hairs to the hide, the shooting of moving animals will spoil them for trophies. Antelope killed while running invariably scrape off large patches of hair when they fall, even when struck a fatal blow

in moderate flight. This knowledge should impel a hunter to appreciate the need for stalking this game. The American pronghorn is a fine trophy animal, but must be carefully taken to retain its value. A skilled hunter will select his prey and stalk it until within shooting range, then kill it with one bullet.

Hide

Aside from the head and horns, few items can be salvaged as mementoes of a pronghorn hunt. Most game animal hides can be used as rugs or finished leather, but antelope hides are useless for these purposes. The hair is too brittle and loosely-attached to make the hide usable as a rug, and when the hair is removed, the skin is of poor texture and of uneven pliability. The finished leather is porous and, after tanning, any bruised portion shows up much enlarged, with the grain exposed. During the serious leather shortage of 1942-45 many attempts were made to utilize these skins, but all resulted in disheartening failures.

References to the use of pronghorn skins for shirts by the redskins are not common in the historical narratives and it is more likely their place was among the ceremonial accoutrements rather than the daily garb of the hunter. An imaginative medicine man may well have seen value in using the hide as a symbol of speed or elusiveness. It has little utilitarian value.

Face

A peculiarity of antelope, which may be noticed in photographic closeups, is their habit of standing motionless with the lower jaw out of line with the upper as they pause when masticating either food or cud. To the casual observer this misalignment appears to be a deformity. Even mounted specimens often show this characteristic. An antelope will appear to have a chew of tobacco in its mouth, even when at

ease and completely relaxed. The mouth will sag lower on one side than on the other. This is well illustrated in Figure 66 (right). Another example will be found in a photograph opposite page 33 of "North American Big Game," a publication of the Boone and Crockett Club. Although it may be an illusion, it appears that the face of the pronghorn photographed would show lack of symmetry if a line were drawn from the tip of the nose to the center of the forehead. Each species has its behaviorisms—its peculiar flight patterns, its food or home building habits. These are hereditary. The pronghorns have many such but as far as I know, the above described mannerism is found in no other species.

Horns

In Oregon, antelope ordinarily shed their horns before December 1, usually between October 15 and November 15. The new horn sheath develops underneath the discarded one, its tip fastened to the horn core. It is very light in color and actually grows both upward and downward at the same time, since it elongates at the terminal end and progresses downward toward the base of the horn core. It can easily be loosened and will fall off if struck. Figure 7.

In January the horn sheath of the buck usually averages $2\frac{1}{2}$ to 3 inches in length, while on the doe it is usually less than 1 inch. There is a scattered but long growth of hair on the lower portion of the core which grows vigorously, making a woolly whorl of hair in front of the ear. As the horn sheath grows downward, it covers the woolly hair mat on the core, which then becomes a portion of the horn sheath. This process finally leaves the antelope with a light ring of hair around the base of the sheath. Figure 6.

Horn growth appears complete in July, and for trophy purposes the horns are in their best condition during July and August, before bucks begin to fight as the rutting season approaches. When rutting begins, horns may be shed prema-

turely by the continual fighting and prodding that goes on amongst the bucks, and unmarred horns are seldom found after the breeding season. Figure 8.

In nature growth is simple yet hard to describe. An example is the simple process of development and transition from a fertilized pheasant's egg to a bird of startling color pattern. The changes that take place in the egg are amazingly direct. The various stages of development show a logical procedure toward the refinement that finally is found in the fully developed bird. Man's handicraft, on the other hand, is untidy to say the least. In his creative moods, vast stores of material are assembled and wastefully used. An example is the crisis brought about by the recent war. We needed rubber and there were possibilities in several fields, but was the approach simple? Hardly. Great structures sprang up. There were international conferences and finally there emerged an amazing pattern of manufacturing machinery which to the novice looked like his boyhood recollection of the insides of Grandpa's watch. After a complicated chemical action of breaking down and building up, inverting and distilling a synthetic rubber emerged.

I have been stirred to this digression by the phenomenon of horn growth in the antelope. This process is odd enough to draw the attention of naturalists and for many years an argument raged as to whether these animals did or did not shed their horns. This difference of opinion merely accentuates the fact that unless we observe animals continuously, simple changes are unnoticed. In the pronghorn, the horn structure is made up of two separate parts, the horn sheath which is visible to the eye, and the horn core which is covered by the sheath except for the short periods of the year. Audubon, perhaps interested more in artistic values than animal anatomy, argued that horns could not be shed, all reports to the contrary notwithstanding. Presumably, he observed that the horn symmetry changed little from season to season. He had not noticed that the horn cores which might

be found on the animal from October to January in much of the western range did not possess a prong.

The horn cores are smooth and their relation to the horn sheath can be likened to a hunter's knife and sheath; the knife being analogous to the horn core. In Oregon, the sheath with its prongs may be shed by the buck as early as the last week in September, but generally remains attached to the horn core until the middle of October. Since they are lightly attached, however, and are held only by hair filaments, they are often struck off by the bucks when fighting during the rutting season. The boney horn core has a tip of light plasticlike material. After loss of the horn sheath, this develops rapidly and takes on the symmetry of a finished horn tip. This tip grows downward. It is apparently fed through the circulatory system culminating in the horn core. In addition to the horn tip of denser material, the horn core is covered by a membranous material which runs down until it comes in contact with coarse hairs which surround the base of the core. It is difficult to tell when the horn becomes predominantly hair or membrane, and gradually the new horn sheath takes shape. The process is very rapid and in the adult bucks the prong on the horn sheath may become visible early in the year. On the immature bucks this may not occur until April or May, and on yearlings much later. For this reason, early naturalists failed to observe the differences that existed seasonally and a natural phenomenon which really should have raised no argument became the center of a heated discussion. The process of horn-change on bucks and does is about the same, but in the does and young antelope the ultimate development is much less than in the mature bucks. Figure 11.

Among many of the horned animals, such as deer or elk, areas of heavy winter concentration can be quite easily detected where ground cover is not too great, by counting the horns scattered about. This practice is not feasible with antelope since they cover such large areas in a day, and the dis-

integration of the hair sheath begins as soon as it is dropped and only under unusual conditions will be found on the ground a year later. Coyotes and rodents also destroy the sheaths soon after they are dropped, by gnawing on them.

Like many of the horned forms, pronghorns have a wide diversity in horn shapes. The females usually have small horns, less than ear length, but occasionally they bear horns comparable to those of mature bucks. While observing the species in Oregon, the author has seen two does with fully developed sets of horns, and several times hunters reported similar specimens taken by them in open season. The angle at which horns are set, or the symmetry that develops, may vary greatly, although, as in deer, it appears that the most grotesque horns are found on the mature bucks approaching senility.

Hoofs

Antelope have larger front than hind feet. The body weight is carried principally on them when running. The rear legs merely act as supports and do not strike the ground so forcefully.

Pronghorns more than other big game mammals appear to use their forefeet for digging and in snow they will use them to expose new grass. Thus, on Drake's Flat in January 1941, did an antelope herd uncover brome and fescue, which had started to grow during the mild weather preceding a light snowfall.

The most common use of the forefeet is to scratch depressions for the deposit of body waste. This is repeated innumerable times daily and might have some bearing on their increased size, as continual use would tend to enlarge them.

Hoof sizes of the average adult buck are as follows:

Front hoof, measured from pointed anterior end to rounded posterior end, longest distance— $2\frac{7}{8}$ inches.

Rear hoof, measured in the same manner— $2\frac{1}{2}$ inches.

The fact that the hoofs are broader on the front feet than

on the hind feet also is an advantage, in that they are not so likely to slip between crevices. When extended to their full width while in flight, the cloven hoofs actually cover an area of about 9 square inches, thus covering many of the narrow cracks in the rock or parched soil.

Unlike deer, the pronghorns have no dew-claws. Their legs are examples of graceful, yet sturdy, design, and the practice of leg defilement by deer, making them malodorous, is not common to the pronghorns.

Teeth

The dental formula for the family is, as in sheep, cattle and goats, $\frac{0\ 0\ 3\ 3}{3\ 1\ 3\ 3}$. In the young, teeth develop rapidly, and by fall, although development is not complete, they compare in size with those of the adults.

In the arid range lands of Oregon, where pumice, gritty soil and sand predominate, little reliance can be placed on determining the age of a pronghorn by an examination of its teeth. The abrasive character of this material wears teeth excessively, and a 2-year-old may have such worn and serrated teeth that upon this basis alone it would be readily classified as a mature animal. This effect is not confined to pronghorns alone. Mule deer and domestic animals suffer similarly. On such ranges ewe sheep may be affected in their foraging and be marketed a year earlier than on better pastures. This excessive wear is common to the ruminants, or cud-chewing animals, in such places, since the teeth are exposed twice to the gritty food. Horses on the same range do not show the same amount of wear on their teeth.

Anatomical and Physiological Peculiarities

No attempt was made in this study to acquire a comprehensive knowledge of pronghorn anatomy. Attention was lim-

ited to solving some of the perplexing anomalies common to the species and to developing information important to the care and proper use of the carcass as game meat. Published material on the subject was found to be extremely limited. Antelope have been studied so little that rudimentary knowledge of their structure is lacking.

For years, various game forms have been credited with the possession of scent-producing glands, supposedly of great importance in the life of the animal. For example, most books on hunting carry numerous paragraphs on dressing and how to avoid ill-flavored meat by treating glandular organs. Although literature is replete with allusions to such glands in the antelope anatomical research has isolated few such organs. This suggests that much that has been accredited to scent glands may better be attributed to ordinary body odors of an animal whose food and habitat are closely related to pungent plants. Dr. M. P. Chapman of the veterinary staff of Oregon State College found that pronghorn glands were similar to those of sheep, the interdigitals being obvious. Persistent searches for external evidence of scent-producing glands reported in the rump patch or rosette failed to reveal their presence and many investigations of these sections support these findings. Sebaceous glands having microscopic outlets similar to those in the palm of a human hand and producing an oily exudate are common on the body of the animal but no large obvious terminal outlets of glands other than those mentioned above are apparent. Perspiration is limited to the area of the nose where globules of moisture may be seen after the animal has been active. Animals which have a high rate of evaporation through the lungs usually perspire less. This is certainly true of the pronghorn; and perhaps the large trachea and ample respiratory system carry the major share of this essential function.

So there is little for the hunter to worry about in dressing an animal except the neatness commonly expected in handling food for the table. The relationship of this fact to

proper care of the meat will be discussed under a subsequent caption.

The eyes of the pronghorn are an effective aid in protecting the species. Aside from their keen vision the eye is remarkably large. Pronghorn eyes are as large as those of a horse. The eyeball itself is about 1.5 inches in diameter and, with its fatty attachments and muscle, exceeds 2 inches. The eye of a horse is from 1.3 to 1.7 inches in diameter and is not so well protected as that of the pronghorn. The eyes of the pronghorn are set so deeply in the orbit that it is necessary to chip away the rim of the orbit to remove an eye intact from its socket. Few animals have such protection. This is important when feeding among bushes like sage, salt-bush, mesquite and other stiff growths, where a less protected eye might be injured.

In some bovines the lachrymal glands form obvious depressions just below the eye and nearest the nose. In mule deer they are especially noticeable when the animal is irritated. Then they appear to unfold and instead of being about one-quarter inch across, the duct which runs into the nasal passages expands to measure fully an inch in width. Pronghorns do not have such glands. Their faces are beautifully molded with well-defined, yet soft, color blendings.

Another interesting external feature is the cartilaginous padding of the hoofs of the pronghorn, especially on the forefeet. This forms a cushion that is resilient to shock and being without nerves the pronghorns suffer little from tender feet even though they run continuously on abrasive rock outcrops. The legs are well adapted to severe weather conditions that prevail on their customary range. Just enough blood circulation is supplied to maintain a good healthy condition of bones and the pelage appears to be especially adapted to exclude the frigid blasts of winter. This hair is not of the same type as the body hairs, being short, fine and vigorously attached so that it can withstand wear when the pronghorn runs through sage or chafes against the lava rock in its

travels. Further specialization is found in the joints of the lower leg which compare to the human ankle or the fetlock joint of the horse. These are joints which through a combination of bone fitting, tendon, and ligament carry the entire body weight of the animal. In certain positions the strain is very great, yet few injuries to these members seem to be suffered. The apparent skill which pronghorns display in preventing accidents to limbs as they run over rough or broken ground is in a large degree due to the perfection of structural design which permits free movement, yet effectively binds and supports the articulated members, thus preventing strains, sprains or other injuries. The length of tendons and ligaments is so nicely adjusted that only in the rarest instance can a bone be so forced beyond its usual position as to result in damage.

In comparing antelope with other range animals there are obvious structural differences. Let us consider the leg structure of the cow and the antelope.

Although the latter may weigh only a tenth as much as the cow, its leg length is about the same, enabling it to forage in the sagebrush stands and yet have good visibility over the surrounding terrain. Cross sections of the antelope's metacarpus show that it has only about one-sixth the area of a mature cow. Both animals have a marrow space in the metacarpus, but in the antelope this space is very small and the bone is further strengthened by a finer texture and a peripheral layer, which functions as a firm support to the leg bone when it is subjected to unusual strains, as in jumping. Thus the bone which is subjected to severe tests is strengthened by this lamination. This is particularly apparent in examining the leg bones of a recently killed pronghorn. It is not so obvious in the skeletal remains found on the desert, as weather action, especially summer heat, quickly imparts a uniform color pattern to the entire bone, concealing this fact from casual inspection, although it does not change the minute texture of the bone in the least. The hooves of the cow do

not carry the cartilaginous cushions. Being less active and agile, the specialized cushions of the pronghorn have not been necessary for this species.

Comparing the two species further, I was prompted by curiosity to learn the maximum load weight each leg bone would carry before it broke. C. E. Thomas, Professor of Engineering Materials at Oregon State College, made the tests. The foreleg bone of a cow failed at 41,300 pounds of weight load per square inch and a comparable section of antelope did not fail until 45,300 pounds a square inch were applied. The weight of the cow was seven times greater than that of the antelope.

The agility and dexterity of the pronghorn also reduce accidents. This sure-footed and graceful animal does not avoid rough ground, but becomes ever more adept at traversing the rocky outcrops from which cattle clumsily detour and for which they never acquire the same skill.

Little is known of the oxygen demand of antelope but a clue exists in the size of vital organs. This demand must be great. A buck pronghorn has a heart twice as large as that of a sheep of almost equal body weight, with a trachea 5 inches in circumference. A person weighing twice as much as an antelope has a windpipe which averages about .76 inch in diameter. In the pronghorn it is usually 1.6 inches in diameter. When the pronghorn is pressed and seeks escape in flight it immediately opens its mouth to breathe in copious drafts of air to meet the needs of the moment. Apparently the oxygen demand cannot be met by the normal function of breathing through the nostrils. Thus it is seen that the high speeds attained by this animal must be closely associated with large oxygen supplies. In spite of the large windpipe, lung, and heart capacity, prolonged activity leads only to sudden and complete collapse.

The daily habits of the pronghorn reveal a natural response to environmental conditions. In midwinter an entire band may suddenly dash away across the desert in formation

like a phalanx of cavalry. In the heat of summer this never occurs in the same pattern. There are many laggards on contrary courses even when pressed, and if left to themselves, they move in measured tread. The exception is on the occasional chilly day in midsummer. When cold winds blow and snow-spitting clouds hover over the higher elevations, a car driven leisurely over the range is challenged constantly by the antelope. They race alongside, and cross in foolhardy recklessness in front of the oncoming automobile. Their mouths are open, their nostrils are distended, their specialized respiratory system permitting them to extract from the thin air at this height enough oxygen to sustain the exuberant mood of the moment.

Vision

Little escapes the eyes of the antelope but to our minds their reactions seem erratic. When a stationary object is in view, whether friend or foe, the pronghorn appears indifferent. Many times animals which we were stalking turned directly toward us gazed intently, but failed to show any fear until some movement of body or wind classified us as an enemy. They are so familiar with the details of their habitat, however, that any *new* object immediately attracted their attention and aroused their curiosity. A thorough investigation followed. This determined their reactions.

Their eyes are set in orbits which protrude from the skull a little ahead of and below the horn cores. This gives them particularly wide angle of vision. The statement commonly made by hunters that antelope can see behind them has a considerable amount of truth in it. They will often discern movement and then quickly turn so that their eyes can be focused on the object. Their range of vision exceeds that of the horse. In many instances moving objects 3 to 4 miles away attracted their attention, and by their intentness an observer knew that they were focusing on the remote objects. Although nothing was visible to the naked eye, a

binocular often revealed a lone coyote or even a piece of paper fluttering in the wind against a bush.

Weight

The pronghorn is one of the smallest of American big game animals, and as in other species, the bucks outweigh the does. The average buck killed during several hunting seasons in Oregon weighed approximately 114 pounds, although specimens as heavy as 138 pounds were reported. Does averaged 92 pounds, the heaviest weighing 105 pounds. When dressed with the feet removed, the total weight is reduced about 20 per cent. This does not indicate the amount of meat obtained, however. Since the bone structure is dense and the body and limbs lithe, the amount of table meat obtained from a buck averages only about 30 pounds, and that of the doe little more than 20 pounds, considerably less than deer of comparable weight. In 1941, when regulations permitted the kill of either sex and any age class, the average dressed weight of pronghorns taken in Oregon was 65.2 pounds; bucks averaging 72.2 pounds and does, 51.3 pounds. McLean (1944, p. 239) gives weights of dressed pronghorns as 82.1 pounds in 1942 and 92.2 pounds in 1943. Hunting regulations in California for that year prohibited shooting bucks with horns shorter than ears. These are of the same race as found in Oregon, and a similarity in weights has been observed. In the Southwestern States, pronghorns usually weigh less than the Oregon antelope, and in Canada they are about the same.

Behavior

Pronghorns behave differently and also have a different physical appearance in winter than in other seasons of the year. During each winter of our study, we have observed that the rump patches are not so white, they are not so commonly flashed as danger signals, they do not glisten, even in brilliant sunshine, nor are they displayed as they are

in other seasons. This may be because at lower temperatures the body oils may not make the rump patch hairs shiny during wintertime, and the rosette, therefore, may become impotent as a means of signaling; or perhaps since pronghorn winter in snow-covered areas, and a white rosette would be invisible on a background of snow, nature has made other provisions to transmit warnings to the herd. Their tendency to congregate in small groups and closely-packed herds may be a substitute defense tactic.

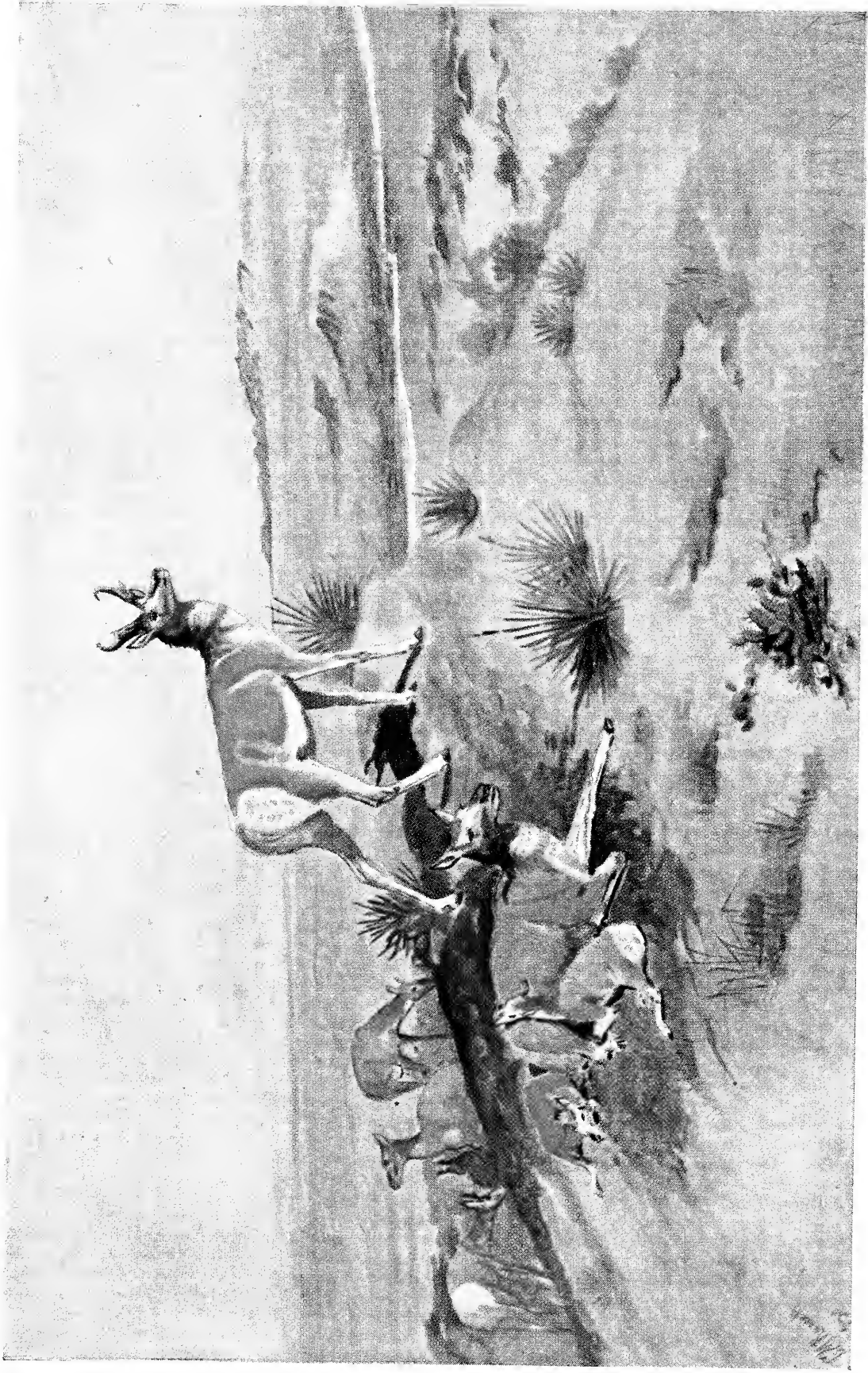
One practice makes them very noticeable on the plains, especially following a sharp run. As soon as they stop all members of the herd will shake their bodies and wriggle their skins, the way horses do after a roll. They do this simultaneously. Their presence is obvious for a second or two and they then blend into the landscape. If you are day-dreaming a bit, you wonder if your mind is not playing tricks and actually you saw nothing. Only the use of good binoculars will relocate the herd. When several hundred antelope shake, usually facing the same direction, even at a distance of 2 or 3 miles, the action causes a flash of color and attracts attention as the body hairs are spread and then quickly returned to their natural position. The effect is like the intricate designs made by the placards of a rooster's section of a holiday football game, and has many times attracted attention to herds that would have been otherwise unnoticed.

While snow is on the ground, especially where it has drifted on windy plateaus, the antelope herds are difficult to see. Time after time large herds, lying asleep in basins sheltered from the wind, at a comparatively short distance from observers have been practically invisible as the white markings and the dull soft pattern of their bodies blend with desert vegetation and snow.

Call

Mature antelope of both sexes express anger or anxiety by an explosive snort or "blow" similar to the blow of a





Reproduction of a Charles M. Russell watercolor by courtesy of James F. Bell, Minneapolis, purchased in Great Falls, Montana, about 1892. This painting catches the color and far distances of pronghorn habitat.

whale. It is done through the nostrils, sounding much like *Cha-oo*, with the accent on the first syllable, and a long pause before sounding the *oo* (as in boot). It is reported that the Klamath Indians claim their name for the antelope to be derived from this call. *Cha-oo* seems best to express the sound, and so they have been named. Pronghorn adults, otherwise, are inarticulate.

Speed

The speed of the pronghorn antelope is one of its most fascinating characteristics. In Oregon there have been excellent opportunities to measure this speed, as several roads intersect or parallel their habitat, and races are frequent. It has been well established that antelope race with any vehicle which passes close to them, especially on cool days, almost as though with pure joy. Unlike cattle, which are slow and given to wandering perversely in front of traffic, pronghorns will parallel it and may vault the road in prodigious leaps of 12 to 20 feet when traveling at a speed of 50 or more miles an hour. Their usual speed is, of course, much less.

Don Robins of the United States Grazing Service, paced 4 bucks for 4 miles near the Tudor Ranch in Malheur County, October 10, 1941. They had already run about one-eighth of a mile before they came parallel to the car, but ran at a rate of about 35 miles an hour for the 4 miles, outdistancing the automobile which was traveling at 30 miles an hour. The sustained speed indicated that it was probably their usual cruising rate since they showed no sign of tiring.

Carlyle Carr (1927), writing of the speed of the pronghorn antelope in the *Journal of Mammalogy*, said: "Antelope in 1918 near a roadway outside of Rincon, New Mexico, averaged 30 miles per hour for 7 miles." Dr. Ira N. Gabrielson reports he has records of speeds up to 55 miles.

The following estimated speeds are from *The Pronghorned Antelope in California* by Donald D. McLean.



The Sedate Walk



The Leisurely Trot



The Sudden, Bounding Leap

Figure 16. Antelope gaits.



The Pompous, Alarmed Walk



The Elegant Trot



The Lope

Figure 16 (continued). Antelope gaits.

<i>Observer</i>	<i>Record</i>
Heller	32 m.p.h. sustained speed
Seton	32 m.p.h. for 1 mile estimate
DeVore	43 m.p.h. (in Seton)
O'Connor	50 m.p.h., whole herds 60 m.p.h., and crossed in front 70 m.p.h., possibly for barren doe 50 m.p.h., bucks, particularly old, are much slower 45 m.p.h., and young buck ran away from car
McLean	53 m.p.h., for 300 yards and holding even—two bucks. Sped up noticeably when shots were fired. Apparently capable of 53 for nearly one-half mile. 42 m.p.h., for one-half mile and then sped up to cross in front of car and ran another one-half mile at about same speed—four does. 45 m.p.h., good buck on dry lake bed for 5 minutes then to 40 and gradually down to 35, and then dodged off as evidently tired. 35 to 40 m.p.h., at a rather long distance but will tire quickly if forced above this as a conclusion.

It is only when hard-pressed that pronghorns attain high speeds. Without a doubt, a 50-mile speed is common, with 60 miles an hour being attained under the best conditions on level ground like desert plateaus or dry lake beds.

On August 14, 1936, I was with a group¹ that paced many pronghorns on the dried bed of Spanish Lake, in Lake County, Oregon. This lake bed was as hard as adobe. It was a clear, breezy day, ideal to stir the racing instincts of the pronghorns, and as we rolled along the lake edge we had many challenges. Small groups here and there raced beside the car, until five, led by a magnificent buck, ran parallel to us, pressing toward the shore from the feeding area in the lake center while we drove on a straight course. As they closed in from the right the buck took a lead of about 50 feet and Meyers increased speed to keep even with the animal. Dean Schoenfeld watched the speedometer, Meyers drove the car and I photographed the moving animals. The

¹Including W. A. Schoenfeld, Dean of the School of Agriculture, Oregon State College, and A. V. Meyers, field observer of the Research Unit.

buck was now about 20 feet away and kept abreast of the car at 50 miles an hour. He gradually increased his gait, and with a tremendous burst of speed flattened out so that he appeared as lean and low as a greyhound. Then he turned toward us at about a 45 degree angle and disappeared in front of the car, to reappear on our left. He had gained enough to cross our course as the speedometer registered 61 m.p.h. After the buck passed us he quickly slackened his pace and when he reached a rounded knoll about 600 feet away he stood snorting, in graceful silhouette against the sky as though enjoying the satisfaction of beating us in a fair race. No sprinter could have posed in victory with a greater show of gratification. His action was typical and indicated no fright, or he would have continued to run until out of sight.

The pronghorn family is perhaps the fastest of all mammals, unless it is outdone by the trained hunting cheetah. Essentially the high speeds of the pronghorns are for short spurts only, but their easy gait of 20-30 miles an hour makes their daily range much greater than that of a slower moving big game species.

In early June of 1935, E. B. Rinard of the United States Navy was traveling across Wyoming by car on Route 30. At about 9 p.m. just west of Cheyenne he saw what he thought to be rabbits running on the prairie close by. By means of a spotlight he quickly determined that they were pronghorns and by the car speedometer he found their speed to be 50 miles an hour. It was an experience which revealed their sure-footedness and the fact that pronghorns are active at night as well as by day.

No description can truly picture the ability of antelope to rise from a prone position. When lying down these animals do not always rest like cattle, with both forefeet and hindfeet doubled under them, but one or even both front feet may be extended. In this position when they rise they merely bridge the ground, as a man might do when lying prone on

his stomach, by rising parallel to the ground on his feet and hands. The action is so rapid that it suggests a steel trap when sprung. The animal then dashes off, not with stiff-legged jumps like the deer, but with each foot engulfing distance with accelerated rapidity until a cruising stride is struck. This action conforms to the accepted description of trotting but to designate a speed of 50 miles an hour as trotting requires some stretch of imagination.

Running is perhaps better explained as a synchronization of motion so that forward progress is marked by the gain that each foot makes, and in direct proportion to the speed with which it is made. Deer lope or bound, making slow progress as compared to antelope. In the antelope, running is an accomplishment that has reached near perfection.

Many of the big game animals are tight lipped in flight, running or bounding as rapidly as possible, and labored breathing soon results. An antelope, when fleeing some menace, fancied or real, starts to run with its mouth open and its tongue often lolling out. Even the kids do this. A 3 or 4 mile run is not uncommon but when an animal is finally driven to the exhaustion point, its collapse is rapid and complete. On level ground, an antelope has been known to run 4 or 5 miles at a fast pace before showing signs of collapse. Ordinarily, in the desert some rocky outcrop or unevenness of terrain will slow down a pursuing man, whether on horseback or in an automobile, with the result that antelope runs usually need be of short duration at such rapid rates. Predators, likewise, force the pronghorns only for short runs in most situations.

The speed with which an antelope can run on broken ground is phenomenal. Very few animals can duplicate this skill.

Antelope as Swimmers

Early explorers and hunters who ranged west of the Mississippi have recorded many instances of antelope swimming.

Most seasonal migrations involved the crossing of water courses, and in the prairie states antelope readily crossed even such large rivers as the Missouri. Pronghorns are alert to the dangers of bogs or quagmires, but will unhesitatingly enter water and swim vigorously if their feet fail to find firm footing. This is common even among kids. On the Malheur National Wildlife Refuge, adult pronghorns have been keeping their kids on islands in the Blitzen River. Since the water is well over the depth of the kids, it is apparent that they swim at an early age, as a few weeks after birth they begin ranging with their mothers.

In Malheur County in midsummer antelope daily cross the Owyhee River and the animals of one herd which I observed stretched out after their dip on a pebbled shore where the bank was low and they were able to relax free from danger.

John Vineyard, whose home is on the banks of Adel Creek in Lake County, reports that in midwinter, as the pronghorns work south from Drake's Flat toward the Black Rock Desert in Nevada, they do not hesitate to swim the creek, although it may be in torrential flood. He reported that a doe antelope drowned in midwinter of 1944 when she was washed against a clump of willows and could not reach open waters again.

Antelope in Winter

With the coming of severe winter weather, the antelope, which have been spread out over wide areas during the late fall months, gradually begin to band together in great herds on fairly well-defined wintering grounds. This gradual drift includes practically all of the individuals and only rarely in Oregon will an occasional isolated buck or a small band be found. It is infrequent enough to be noteworthy when bucks are found by themselves after extreme winter weather sets in. Usually it is because they lack vigor. Occa-

sionally, small bands which have been separated from the herd by human activity may be found widely scattered.

In January 1937, and again in January 1941, we spent considerable time with antelope herds during the most severe part of the winter. On Drake's Flat, in 1941, a band of nearly 1,000 animals were using only about 10 sections of land. The location and concentration of herds are established to a large degree by the severity of the winter weather. The snow gradually encroaches upon their feeding grounds as the season advances, and in several winters for which records are available, antelope were forced down to the lowest valley floor as the snow-line gradually engulfed the entire range. When a whole area becomes snow-covered there is a gradual drift to the ridges, where vegetative stands are more exposed and the animals find food more readily. Here they are also safer from predatory animals, which have an advantage in deep snow. Antelope will be forced off their usual range by heavy snowfalls and are helpless in deep snow if chased by coyotes. Each winter, skeletal remains are found on the antelope grounds of Oregon when snow is of considerable depth or becomes even slightly crusted. Snow which will carry the weight of coyotes, breaks through and lacerates the legs of antelope, and in some years coyotes are said to make vast inroads on the herds of antelope. No such catastrophe has been recorded in Oregon during this study, however. Observed losses were of individual animals.

In the winter of 1939, the antelope herds left Drake's Flat as the snow deepened, working northward through the Coyote and Rabbit Hills country to the Juniper Mountain area, all of which lie behind the great Abert Rim. The Rim catches most of the moisture of the prevailing southwest storms. Rarely is there any appreciable snowfall behind this 30-mile range of hills, so that the mesas and valleys to the northeast usually receive only a light powdering of snow, when Drake's Flat, at an elevation of 5 to 6 thousand feet, may be covered by a foot or more.

Interest in Other Animals

The pronghorn seems to combine the behavior characteristics of several species, among them the goat and the deer. An interesting experience in this connection is worth mentioning. Dave McDonnell, a farmer living near the Warm Springs Reservoir east of Burns, reared an antelope doe from a kid. It could have associated with several domestic animals, but chose a goat. They were about the same age and the two were always found together. Their interest, curiosity, and reaction to human care were about the same, and there was a similarity in their wants and foods. Both also showed a distinct liking for tobacco in any form.

At the Squaw Butte Experiment Station in 1937, a captured antelope, nearly mature, attempted to be friendly with a deer. The deer would have nothing to do with the antelope but for several months the latter persisted and was continually rebuffed.

Sleeping Habits

Antelope sleep often, but without continuity or regularity, and usually for short periods. They sleep both night and day and may be as alert and active at midnight as at midday.

Although asleep, these animals will respond to a strange scent. Often when a sleeping buck is observed at close range, he will leap into action when his nose tells him of the observer's presence.

In the warm morning sun following a stormy night pronghorns seek out southern sheltered slopes and seem to luxuriate in longer than usual naps. Like all animals vulnerable to attack by their enemies they awaken intermittently and scan their surroundings. In these glances they seem to comprehend any changes that have occurred and react accordingly. Without a long training period a man under similar conditions would see little in these quick glances over

the terrain. I, for one, am glad my rest need not be so interrupted to assure my survival.

Curiosity

Antelope are among the most curious of wild animals. Most wild species show interest followed quickly by aversion or fear and then try to escape by headlong retreat. Not so the antelope. It must carefully scrutinize every little fluttering bush. A funnel of dust raised by a desert wind becomes the object of its closest attention. It investigates anything that moves, and this characteristic persists whether the animal is on the range or held in captivity.

In 1937, while a highway east of Burns, Oregon, was under construction, a rock crusher was installed near Buchanan. One of the men working there, William Jordan, reports that while in operation, the crusher was under the closest scrutiny of a gallery of pronghorns, who spent the greater part of the working day on a sloping hillside above it, watching with intense curiosity the action of men and machinery. In 1942, the crusher was moved to a new location about 15 miles west of Burns near Riley. The service station proprietor nearby had reared twin pronghorn kids after their mother had been killed by a car. These kids, about 15 months old, undertook to follow the operations at the rock crusher day after day, although it was necessary for them to walk about a mile to investigate these activities. This curiosity placed them at the mercy of dogs which finally, after many runs, cornered and killed them.

In 1937, R. R. Robinson of Juntura had a pet 2-year-old pronghorn doe, which ran at large in the fields around the village. When the highway was under construction at that point, a gasoline shovel operated near the town, with considerable clatter and great activity of men, trucks and tractors. Mrs. Robinson reported that the animal would stay around the machinery whenever it was in operation. Finally the operator asked her to keep it away as it was in

danger of being run over by the moving equipment. It was shut up in a field, and although it could easily have jumped over the fences, no easy passage was found under the wires, and so the restless antelope was confined without further trouble. If released from the field for a moment, it would go quickly into the little village, attracted to the activity by its inordinate curiosity.

Grouping

Bucks are found in small groups or sometimes alone during the spring months, but are with the does in the breeding season. In midsummer pronghorns of all age classes are in harmonious flocks. Does will be grouped together with both yearlings and immature animals at all seasons of the year except at kidding time, when they seek semi-isolation. They then may be within sight of another doe and her kids or may run together later in the season, but at the time the kids are dropped, the doe usually has chosen an area somewhat remote from others of her kind. Yearlings follow adults, but rarely do they predominate in a herd. It is well known that the pronghorns of all age classes usually band together during the height of winter.

Restlessness, Play Patterns, and Posing

A pronghorn behaves much like a nervous human being. I watched one chewing its cud and gazing motionless toward the horizon, then suddenly bound away, perhaps a distance of 10 miles, to forage daintily on the shores of a drying lake. Although such action might be attributed to hunger, these animals rarely forsake feeding long enough to feel any real need for food. Stomachs which have been collected are nearly always full. Feeding is a persistent habit or a safety valve for boundless energy if the restless foraging of the species is any indication. Too, they may rush away from a spot of plentiful food to one of poor forage. It almost seems as though an animal makes a definite decision as to

where it wants to go, and usually dashes directly to the spot. A duller animal like a cow, never sets such definite goals, despite past experiences, but meanders along, with many detours and digressions.

On May 27, 1937, the author observed a doe with kids feeding contentedly on the northern portion of the Hart Mountain range. She suddenly looked up, stood erect for a moment and gazed toward a spring fully 3 miles away. She then turned her head to bring into view her twin kids, dozing in the morning sun. With an explosive burst of action, finally settling to a gait of about 20 miles an hour, she ran to the spring and from her action as viewed through a binocular, drank, and returned at the same speed, having been away exactly 19 minutes. Her haste to return implied a keen realization of the danger her kids might be in while she was away. They were only a few days old, and completely at the mercy of predators in her absence. Her actions signified complete understanding of the risks they faced alone.

The organized games people play follow a definite pattern. In them imagination is strong. The wild racing of adult antelope at play seems very like our own play. An antelope may start at a distance and race toward companions feeding or dozing in apparent indifference to their kind, until the runner bounds up and makes a feint at the group. Instantly they take their cue and a wild chase ensues with each one contributing something to the pattern. Often a completed game involves a series of complex maneuvers. It may have been mere chance but I thought I often saw a logical end to their play when they paused or stepped out in a different series of antics.

The antelope moves over a wide expanse. His daily doorway is by far the widest of any game animal in the United States, except perhaps that of the cougar, and therefore, can be considered an animal of definite habitat only when great areas are encompassed. Small areas fit a daily need, but not

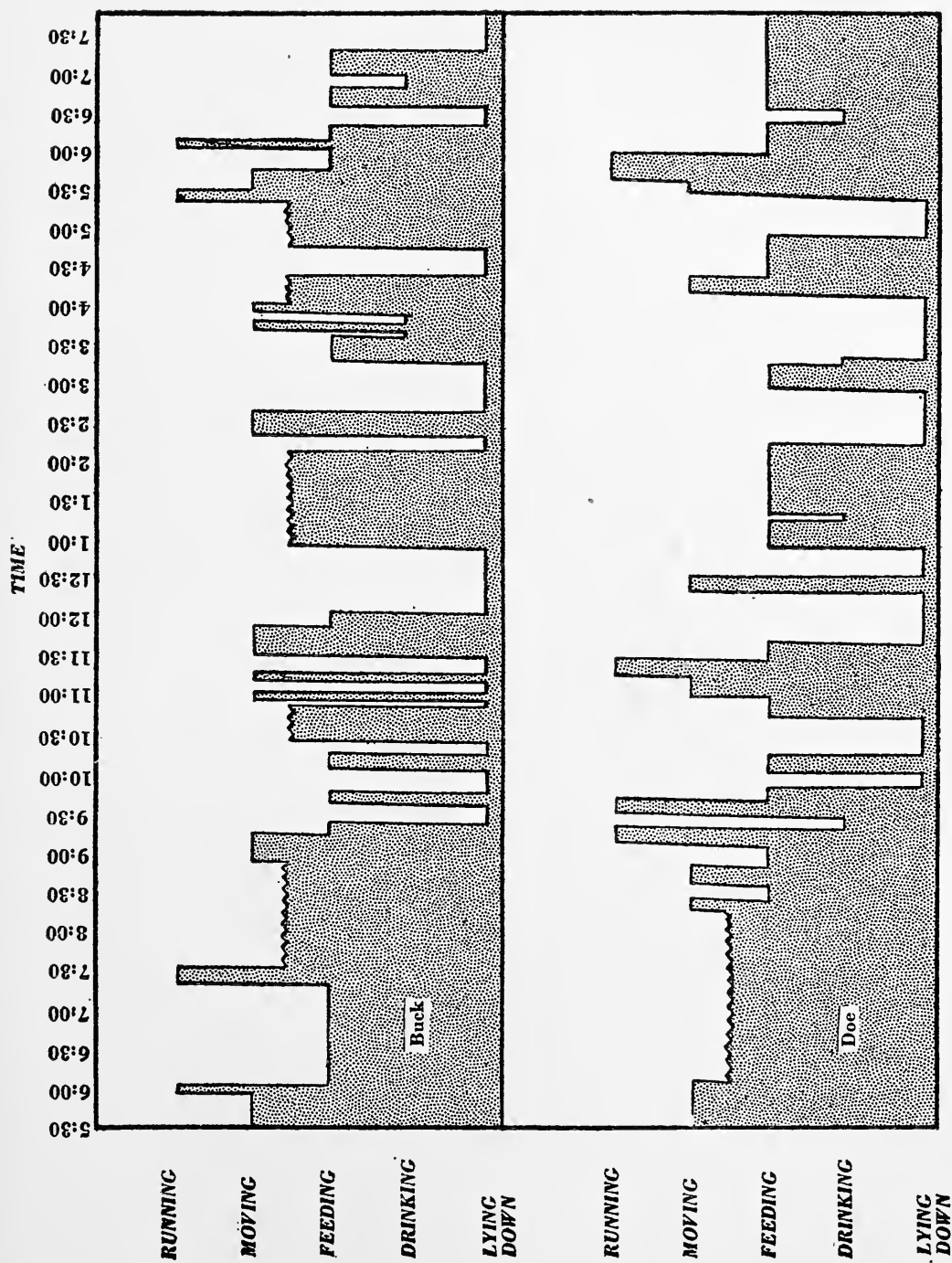


Figure 17. Activity graph of pronghorns. Sleep is intermittent when the animals are lying down.

for long. These we can consider as his orbit. They may vary in radius seasonally. Only patriarchs of the herd restrict themselves to narrow confines. They may select an area and move about very little. For this reason they are often found by travelers and are popular photographic subjects. On several occasions tourists have been advised where to go for pronghorn pictures, and the staid old bucks have obligingly posed against their favorite rimrocks to good effect.

In body beauty few animals equal them. The slender limbs and finely sculptured muscles combine the grace of Apollo and speed of Mercury. Each age class affords an opportunity for fine camera studies, and in the years to come aesthetic satisfaction alone will justify the perpetuation of the species.

Food Habits

An attempt has been made during this investigation to determine the natural preferences of antelope for range grasses, browse plants and range weeds, in comparison to those of domestic animals. The comprehensive list submitted below, compiled from these observations, indicates the appetite of the pronghorn for many plants of the arid plateaus.

Antelope, like other forms of animal life, have preferences for certain foods, and these may predominate at one time or another in stomach analyses. The eagerness with which they seek bull clover (*Trifolium macrocephalum*) and sourdock (*Rumex paucifolius*) would lead a laboratory worker, examining stomachs taken at certain periods of the year, to believe that these two forms of plant life are important. However, the former is rarely so abundant as to contribute much to the food supply except for a few days in spring, and the dock is found only occasionally on dried-up lake beds, which are of such small acreage that they could not meet the food demands of antelope for any length of time. They are but the "ice cream" in the pronghorn's diet.

The lowly and much condemned cheat (*Bromus tectorum*)

is avidly taken as the green shoots emerge. This usually occurs at several periods of the year, and field notes of the Research Unit record its use in winter as well as summer. As cheat is an annual, seeds exposed to moisture and heat may germinate in October or February, as well as during the usual germination period in spring. As a staple food it is probably of little importance, but is preferred when the tender shoots are available, although making up little of the aggregate daily bulk.

Plants do not need to be abundant to provide good pasturage for antelope. On some pronghorn habitat there may be only one plant to each square yard, and the intervening space may be gravel, pumice, or bare igneous rock.

Complete and conclusive proof of antelope dietary needs will require many stomach analyses of species from ranges of different vegetative composition at all periods of the year. This will necessitate collections over a long period of time. There are enough records from *Antilocapra americana oregona* range to indicate the principal foods required.

The collections made under the direction of O. J. Murie, Biologist, United States Fish and Wildlife Service and Research Unit workers, and analyzed by the Food Habits Research Laboratory of the Service at Denver, Colorado, follow a general pattern. It is apparent from these analyses that browse plants are the sustaining food types. These are followed, in the order of their importance, by weeds and, finally, grasses. In areas where farming is adjacent to pronghorn habitat, farm crops may precede grasses, as the latter contribute such a small percentage of the daily pronghorn foods that they are quickly relegated to a position of minor significance if other foods are available.

Daily observations of feeding pronghorns quickly established the importance of the various species of sage in the diet. Of these, *Artemisia tridentata* and *Artemisia t. arbuscula* were more frequently browsed.

TABLE 2.

Antelope Foods Identified from Sight Records in Oregon
1936-1944**Browse**

<i>Artemisia nova</i>	Black sagebrush
“ <i>spinescens</i>	Bud sagebrush
“ <i>tridentata</i>	Big sagebrush
“ “ <i>arbuscula</i>	Sagebrush
<i>Atriplex canescens</i>	Fourwing saltbrush
“ <i>confertifolia</i>	Shadescale
“ <i>semibaccata</i>	Saltbrush
<i>Chrysothamnus nauseous</i>	Rubber rabbitbrush
<i>Eurotia lanata</i>	Winterfat
<i>Grayia spinosa</i>	Hop sage
<i>Juniperus occidentalis</i>	Western juniper
<i>Purshia tridentata</i>	Bitterbrush
<i>Pyrus</i> sp.	Apple tree leaves

Range Weeds

<i>Agoseris</i> spp.	Goat chicory
<i>Allium acuminatum</i>	Wild onion
<i>Aralis</i> sp.	Mustard
<i>Arnica foliosa</i>	Leafy arnica
<i>Astragalus mollissimus</i>	Woolly loco
“ <i>purshii</i>	Woolly podded locoweed
<i>Chenopodium</i>	Lamb's quarter
<i>Crepis</i> sp.	Hawksbeard
<i>Delphinium andersoni</i>	Larkspur
“ sp.	Larkspur
<i>Eriogonum ovalifolium</i>	Cushion eriogonum
“ <i>umbellatum</i>	Sulphur
“ <i>vimineum</i>	Broom eriogonum
<i>Erodium cicutarium</i>	Filaree
<i>Leontodon taraxacum</i>	Dandelion
<i>Lomatium</i> (<i>Cogswellia</i>)	Sweet anis
<i>Lathyrus</i> sp.	Wild pea vine
<i>Lupinus brevicaulis</i>	Lupine
“ <i>caudatus</i>	Lupine
“ sp.	Lupine
<i>Medicago sativa</i>	Alfalfa
<i>Melilotus</i> sp.	Sweet clover
<i>Osmorhiza occidentalis</i>	Sweet anise
<i>Ranunculus glaberrimus</i>	Sagebrush buttercup
<i>Rumex paucifolius</i>	Sourdock
<i>Salsola pestifer</i>	Russian thistle
<i>Trifolium rydbergii</i>	Rydberg clover
<i>Verbascum thapsus</i>	Common mullein
<i>Zygadenus paniculatus</i>	Death camas

Grasses

<i>Agropyron pauciflorum</i>	Slender wheatgrass
“ <i>spicatum</i>	Bluebunch wheatgrass
<i>Agrostis alba</i>	Red top
<i>Bromus carinatus</i>	Mtn. brome
“ <i>marginatus</i>	Cheat
“ <i>tectorum</i>	Downy brome
<i>Danthonia</i>	Oatgrass
<i>Distichlis spicata</i>	Saltgrass
<i>Festuca idahoensis</i>	Idaho fescue
<i>Hordeum jubatum</i>	Foxtail grass
“ <i>nodosum</i>	Meadow barley
“ <i>vulgare</i>	Barley
<i>Phelum alpinum</i>	Alpine timothy
<i>Oryzopsis hymenoides</i>	Indian rice grass
<i>Poa pringlei</i>	Pringle bluegrass
“ <i>scabrella</i>	Pine bluegrass
“ <i>secunda</i>	Bluegrass
<i>Sitanion hystrix</i>	Squirrel tail
<i>Stipa comata</i>	Needle-and-thread grass
“ <i>occidentalis</i>	Western needlegrass
<i>Triticum aestivum</i>	Wheat

Grasslike Plants

<i>Carex douglasii</i>	Saltgrass or sedge
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Murie, in writing of his own investigations, said in a letter of May 15, 1941: “Antelope are fond of weeds (forbs) in summer, while at the same time they continue to feed on sage. In winter the sage is the important food item.”

R. L. Grimm (1939) writes: “Antelope, however, consume very little grass but a great deal of weeds and browse,” and offers proof of the importance of sage by citing records of study plots, as follows:

Weight of Clippings in Grams (Sagebrush)

	Oct. 1937	Apr. 1938
Plots 4 to 12	1,537	267

and continues, “The difference between these two weights is 1,250 grams, making the proportion of utilization 81.3%.”

The Range Plant Handbook of the United States Forest Service, (March 1937) says: “Despite its low palatability, chemical analysis indicates that the leaves of big sage (*Artemisia tridentata*) equal alfalfa meal in protein, have a higher

TABLE 3.

Food of Antelope¹

Scientific Name	Common Name	Times Used	Localities (shown graphically)	Volumetric Per cent
			BROWSE	
<i>Artemisia tridentata</i> <i>arbuscula</i>	Sagebrush	11	3	32.46
<i>Artemisia tridentata</i>	Big sagebrush	12	3	27.76
<i>Atriplex</i> sp.	Saltbrush	5	3	2.73
Other browse				1.60
<i>Purshia tridentata</i>	Bitterbrush	2	1	1.00
<i>Chrysothamnus</i> <i>nauseosus</i>	Rubber rabbitbrush	5	4	.65
Other Forbs			RANGE WEED	
<i>Phlox</i>		9	4	17.65
<i>Liatris punctata</i>		1	1	6.15
<i>Amaranthus</i>		1	1	1.62
<i>Salsola pestifera</i>	Russian thistle	2	1	1.54
<i>Boraginaceae</i>		2	1	1.11
<i>Astragalus</i>	Locoweed	2	1	1.08
Grasses			GRASSES	
				.85
				2.62

¹Foods found in 26 antelope stomachs divided into these classifications, browse, range weeds and grasses, and listed in the order of percentage used. Fifteen samples taken on the adjoining Oregon and Nevada ranges and 11 from Wyoming range for comparison.

carbohydrate content and yield twelvefold more fat." Although the writer in the Range Plant Handbook was no doubt referring to food for cattle the leaves of the sage are not unpalatable to the pronghorn, whose feeding habits are suited to this plant.

In Oregon, Dr. J. R. Haag, Nutritional Chemist, Oregon Agricultural Experiment Station, analyzed samples from the Squaw Butte Range Experiment Station, near Burns, Oregon, as follows:

Artemisia Tridentata

Time	Protein Content
May 10	15.83
June 8	15.86
July 8	11.58
Aug. 3	9.40
Aug. 22	9.85
Oct. 30	8.51
Dec. 6	8.73
Dec. 18	8.91

These analyses show that Oregon sage has a substantial protein value. It is remarkable that it attains such a high percentage as early in the year as May. Its midwinter nutritive value does not drop below the critical point. If the diets of Columbian black-tailed deer in the Coast Range fall below a protein content of 5 per cent, malnutrition quickly develops. It has been observed that few losses occur when mule deer wintering on overbrowsed areas are forced by snow upon adjacent sagebrush flats. This is probably because of the high food value of the sage.

The following analyses¹ of 31 pronghorn stomachs reported from South Dakota in the *Pittman-Robertson Quarterly*, January 1943, show that two-thirds of the contents were browse species; nearly one-sixth, forbs; and one-eighth, farm crops, and the remainder, less than 1 per cent, grass. Here, too, sagebrush ranks first in importance as a staple food.

¹From *Pittman-Robertson Quarterly*, Vol. 3, No. 1, 1943. South Dakota 12-R State-wide Big Game Survey, Phillips Hass, Leader, p. 32.

TABLE 4.

Tabulation of Contents of 31 Pronghorn Stomachs

Collected in Lemhi and Butte Counties, Idaho
September 26-30, 1940

Browse	Per cent
Sagebrush (<i>Artemisia</i> spp.) -----	46.6
Buckbrush (<i>Symphoricarpos</i> spp.) -----	11.0
Rabbitbrush (<i>Chrysothamnus</i> spp.) -----	9.2
Rose (<i>Rosa</i> spp.) -----	1.3
Unidentified browse -----	0.6
	<hr/> 68.7
Forbs	
Weeds -----	16.0
Cactus (<i>Opuntia</i> spp.) -----	1.8
	<hr/> 17.8
Farm Crops	
Alfalfa (<i>Medicago sativa</i>) -----	8.8
Grain -----	4.0
	<hr/> 12.8
Grass -----	0.7

Fall foods of the pronghorn antelope in Harding and Butte Counties of South Dakota, as indicated by 48 stomach samples, taken from August to October, 1942-43 and reported in the *Pittman-Robertson Quarterly* for January, 1944, were as follows: Sagebrush, 39.5 per cent; other browse species, 23.4 per cent; total browse, 62.97 per cent; weeds, 25.93 per cent, and crops, 11.1 per cent.

Food contents of antelope of Colorado, mentioned in the same quarterly are classified as follows: browse, 84 per cent; weeds, 10 per cent; grasses, 6 per cent. Sagebrush, rabbitbrush and cactus were the most common browse species.

Pronghorn stomach samples collected in Idaho are of considerable interest in determining food preferences. Of this group, Dr. D. I. Rasmussen, Leader of the Utah Cooperative Wildlife Research Unit, comments as follows: "Some (antelope) were killed on and near alfalfa fields and in two cases practically all the stomach contents was alfalfa." It is most enlightening, to discover from the Idaho analyses that every stomach contained the species of plant which appears

TABLE 5.

Tabulation of Contents of Antelope Stomachs Collected in Utah — 1945

Adults (6 stomachs)

	<i>Times Used</i>	<i>Volumetric Per cent</i>	<i>Graphically</i>
<i>Undet</i>	6	34.17	
<i>Chrysothamnus</i> ..	6	20.00	
<i>Juniperus</i>	6	15.83	
<i>Artemisia</i>	6	8.33	
<i>Atiplex</i>	4	5.83	
<i>Cercocarpus</i>	4	5.83	
<i>Descurainia</i>	4	4.17	
<i>Penstemon</i>	4	1.67	
<i>Gutierrezia</i>	2	1.67	
<i>Euphorbia</i>	6	.83	
<i>Sphaeralcea</i>	1	.83	
Manila paper	1	.83	
<i>Hordeum</i>	2	T	
<i>Iva</i>	1	T	

Fawns (3 stomachs)

	<i>Times Used</i>	<i>Volumetric Per cent</i>	<i>Graphically</i>
<i>Undet</i>	3	31.67	
<i>Chrysothamnus</i> ..	3	21.67	
<i>Cercocarpus</i>	1	16.67	
<i>Juniperus</i>	2	10.00	
<i>Descurainia</i>	1	8.33	
<i>Artemisia</i>	3	6.67	
<i>Atiplex</i>	2	3.33	
<i>Euphorbia</i>	1	1.33	
<i>Pursia</i>	1	T	
Manila paper	1	T	
<i>Hordeum</i>	1	T	
<i>Sphaeralcea</i>	2	T	

to be the staple food of the antelope — *Artemisia*, or sage. In a situation where the animals probably could have eaten alfalfa exclusively, none failed to include some of this ever present range plant.

Like most birds and animals, the pronghorn adjusts its diet to the available supply, although the number of foods taken is large and varied. It often resorts to cultivated crops, especially alfalfa but the vegetative stand is rarely reduced appreciably by feeding. In locations where small alfalfa fields are most important to the rancher, the persistent depredations of pronghorns are a vexing nuisance. These forays into hayfields may provide only a small portion of an antelope's food requirements, but cause serious damage to the crops by their incessant standing up and lying down in nervous fidgeting, leveling great expanses of alfalfa or grain, to the farmer's loss and despair.

In late winter or early spring, pronghorns will feed avidly on the tender new shoots of most grasses as they appear. Feeding is systematic and this intensive use may keep the new grasses close-clipped. On open range, spring utilization of green foods, which includes many of the grasses, may have considerable effect on the green food later available for sheep or cattle, as pasture grasses in May or June are greatly decreased.

As the season progresses, the use of range weeds, grass-like plants and browse reduces consumption of grasses, and there are so many plants palatable only to antelope that there is no continuous direct competition between antelope and domestic animals in Oregon. This is especially noticeable on range where antelope forage persistently, and where domestic animals have been controlled or prohibited from entering, for example on the Hart Mountain Antelope Refuge. After its creation, grazing by domestic animals was prohibited as a restoration measure, and although 3 or 4 thousand antelope used the range, their effect upon the vegetation could not be detected, and it soon became apparent that controlled grazing by domestic animals was ad-

visible. The fire hazard, resulting from dry grass in a country where lightning storms are common, jeopardized the entire refuge. The reopening to grazing by domestic animals quickly corrected the condition.

In 1939 and 1940, a similar condition developed in many parts of southeastern Oregon. With the advent of difficult times for cattle and sheep men in the early thirties, much of the stock was removed from the range, and later, under the Taylor Grazing Act, further control and a second period of financial difficulty left great expanses of ground untouched by domestic livestock. Throughout this period antelope herds increased and used these areas more actively each season. Their effect upon grass stands was negligible. Wide expanses of range carried grasses as abundant as in the days of the first settlers despite increasing use of the range by antelope.

The comeback of grasses on ground of poor fertility, as in the gravelly soil west of Crooked Creek extending many miles toward the Steens Mountains, was phenomenal, despite daily use by antelope. Much range was restored during this period by the restrictions of domestic livestock.

It is apparent that when grass becomes rank and coarse, antelope leave it alone, although it may continue to be palatable to domestic animals. To say that all antelope ground must be grazed, however, is a fallacy, as in the years of general antelope abundance through the plains states, antelope often fed on ground unoccupied by other grass-eating animals. In the economy of today, multiple use is desirable.

The species and maturity of grass, weeds, and browse plants have a direct influence on antelope habitat, and much land in the southwestern portion of the United States, which is too sparsely vegetated for domestic animals, could carry small pronghorn herds.

Of the antelope stomachs analyzed for the Oregon Research Unit, few were found that were not completely full. This may indicate a slow digestion process or frequent feeding, even at night. Observation of their habits indicates that

they waste little of what they eat. The body waste of cattle is much more noticeable. Only rarely are cattle so well fed that they ignore the food on the range for a lengthy period. Antelope too, follow this practice, although they are dainty foragers. Rarely do they feed heavily at one place, but with nervous haste will leave a stand of abundant food to move either feet or miles to a more appealing spot, even though it is sparsely vegetated. Food may be scarce on the new ground but, after all the change satisfies, at least temporarily.

On May 9, 1937, a doe was seen feeding on bunchgrass (*Festuca idahoensis*). She moved away about 20 yards and cropped the upper leaves of a poisonous larkspur plant. She then trotted 80 yards to a spot where she ate grass again for about 2 minutes. Coming back to the original place she lay down, chewed her cud for about 20 minutes, then arose hastily to rush over the crest of a ridge some distance away, to feed again on bunchgrass.

The nervous nature of antelope shows in every action. When feeding, it is well exemplified by their active foraging. Even when they are feeding on cultivated ground in the grain or alfalfa fields of the irrigated country in southeastern Oregon, they walk about rapidly, leaving one stand of vegetation for another that may not be as good. Except in periods of heavy dew, their course can hardly be traced through grain or grass by their feeding signs. Cropping can be noticed only by close inspection.

Antelope eat with a clean-cut bite. They seldom pull plants out by the roots, as cattle may do on soft ground, since they bite rather than pull the herbage from the plant. Cattle take food plants between the lower teeth and upper lip, and with a wrenching motion attempt to tear out the vegetative part, often pulling up the whole plant in the process, if the ground is not firm. Even when antelope have lost their incisor teeth they seem able to crop vegetation so as not to disturb the plants. In grain fields, the maturing heads are often taken. In alfalfa fields, the tender stalks or tops appear equally acceptable.

TABLE 6.
Oregon Range Plant Palatability to Antelope,
Cattle and Sheep

Plant	Antelope	Cattle	Sheep
BROWSE			
<i>Artemisia spinescens</i>	Excellent	Good	Good
“ <i>tridentata</i>	Excellent	Fair ¹	Fair ¹
<i>Atriplex canescens</i>	Excellent	Good ¹	Good ¹
“ <i>semibaccata</i>	Excellent	Good	Fairly good
<i>Chrysothamnus nauseosus</i>	Good	Unpalat. ¹	Unpalat. ¹
<i>Eurotia lanata</i>	Excellent	Good ¹	Good ¹
<i>Grayia spinosa</i>	Good	Poor	Poor
<i>Juniperus occidentalis</i>	Good	Poor	Poor
* <i>Purshia tridentata</i>	Good	Good ¹	Good ¹
RANGE WEEDS			
<i>Allium</i>	Good	Excellent	Excellent
<i>Arnica foliosa</i>	Good	Unpalat. ¹	Fair ¹
<i>Astragalus mollissimus</i>	Fair	Unpalat. ¹	Unpalat. ¹
“ <i>purshii</i>	Fair	Unpalat. ¹	Unpalat. ¹
<i>Delphinium andersoni</i>	Poor	Unpalat. ¹	Unpalat. ¹
<i>Eriogonum ovalipolium</i>	Good	Unpalat. ¹	Fair ¹
“ <i>umbellatum</i>	Good	Unpalat. ¹	Fair ¹
<i>Erodium cicutarium</i>	Fairly good	Good ¹	Good ¹
<i>Leontodon taraxacum</i>	Fair	Good ¹	Good ¹
“ (<i>Cogswellia</i>)	Fair	Fair ¹	Fair ¹
<i>Lupinus brevicaulis</i>	Good	Good	Good
“ <i>caudatus</i>	Fair	Good ¹	Good ¹
<i>Lupinus leucophyllus</i>	Good	Good	Good
<i>Medicago sativa</i>	Good ¹	Good ¹	Good ¹
<i>Osmorhiza occidentalis</i>	Good	Good ¹	Good ¹
<i>Ranunculus glaberrimus</i>	Excellent	Fair ¹	Fair ¹
<i>Rumex paucifolius</i>	Excellent	Fair	Fairly good
<i>Salsola pestifer</i>	Fair	Fair ¹ (early)	Fair ¹ (early)
<i>Trifolium rydbergii</i>	Good ¹	Good ¹	Good ¹
<i>Verbascum thapsus</i>	Fair		
<i>Zygadenus paniculatus</i>	Fair	Unpalat. ¹	Fair ¹
GRASSES			
<i>Agropyron pauciflorum</i>	Good	Good ¹	Good ¹
“ <i>spicatum</i>	Fair	Good ¹	Good ¹
<i>Bromus carinatus</i>	Good	Good ¹	Good ¹
“ <i>Tectorum</i>	Excellent	Fair ¹	Fair ¹
<i>Distichlis spicata</i>	Fair	Fair ³	Fair ³
<i>Festuca idahoensis</i>	Good	Good ¹	Good ¹
<i>Hordeum jubatum</i>	Poor	Fair ¹	Fair ¹
“ <i>nodosum</i>	Fair	Good ¹	Good ¹
“ <i>vulgare</i>	Poor	Good	Fairly good

TABLE 6. (Continued)

Plant	Antelope	Cattle	Sheep
<i>Oryzopsis hymenoides</i>	Fair	Good ¹	Good ¹
<i>Phleum alpinum</i>	Poor	Good ¹	Fair ¹
<i>Poa pringlei</i>	Good	Good	Good
" <i>scabrella</i>	Fair	Good ²	Good ²
" <i>secunda</i>	Good	Good ¹	Good ¹
* <i>Sitanion hystrix</i>	Poor	Fair ¹	Fair ¹
* <i>Stipa comata</i>	Poor	Fair ¹	Fair ¹
" <i>occidentalis</i>	Poor	Fair ¹	Fair ¹

GRASSLIKE PLANTS

<i>Carex douglasii</i>	Fair	Good	Good
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*Only during certain seasons.

¹Range Plant Handbook of the U.S.D.A. Forest Service, March 1937.

²Hitchcock, A. S. 1920. *The Genera of Grasses of the United States with Special Reference to the Economic Species*. U.S.D.A. Bulletin, 772.

³Sampson, A. W. 1924. *Native American Forage Plants*. New York: John Wiley & Sons, Inc.

TABLE 7.

Seasonal Use of Vegetation by Antelope¹

Plant	Spring April 1- June 30	Summer July 1- Aug. 31	Fall Sept. 1- Oct. 31	Winter Nov. 1- Mar. 31
BROWSE				
<i>Artemisia tridentata</i>	Yes	Yes	Yes	Yes
<i>Atriplex canescens</i>	Yes	No	No	Yes
" <i>confertifolia</i>	No	No	No	Yes
<i>Eurotia lanata</i>	Yes	No	No	Yes
<i>Grayia spinosa</i>	No	Yes	No	Yes
<i>Juniperus occidentalis</i>	No	No	Yes	No
<i>Purshia tridentata</i>	Yes	No	No	No
RANGE WEEDS				
<i>Allium acuminatum</i>	Yes	No	No	No
<i>Arahis</i> sp.	Yes	No	No	No
<i>Arnica foliosa</i>	No	Yes	No	Yes
<i>Astragalus purshii</i>	Yes	No	No	No
Clover	No	Yes	Yes	No
" sweet	No	No	Yes	No
<i>Crepis</i> sp.	Yes	No	No	No
<i>Delphinium</i> sp.	Yes	No	No	No
<i>Eriogonum caespitosum</i>	No	Yes	No	No
" sp.	No	Yes	No	No
" <i>vimineum</i>	No	Yes	No	No

TABLE 7. (Continued)

Plant	Spring	Summer	Fall	Winter
	April 1- June 30	July 1- Aug. 31	Sept. 1- Oct. 31	Nov. 1- Mar. 31
<i>Lathyrus</i> sp.	No	Yes	No	No
<i>Leontodon taraxacum</i>	No	Yes	No	No
<i>Lomatium</i> (Cogswellia)	Yes	Yes	No	No
“ <i>Nevadeusis</i>	Yes	No	No	No
<i>Lupinus brevicaulis</i>	Yes	No	No	No
“ <i>Caudatus</i>	Yes	No	No	No
“ sp.	Yes	No	No	No
<i>Medicago sativa</i>	No	Yes	Yes	No
<i>Melilotus</i> sp.	No	No	Yes	No
<i>Oenothera tanacetifolia</i>	Yes	Yes	No	No
<i>Renunculus glaberrimus</i>	Yes	Yes	No	No
<i>Salsola pestifer</i>	No	Yes	No	No
<i>Trifolium cyathiferum</i>	Yes	Yes	No	No
“ <i>macrocephalom</i>	Yes	Yes	No	No
“ <i>plummerae</i>	Yes	No	No	No
“ sp.	Yes	Yes	No	No
<i>Zygadenus paniculatus</i>	Yes	No	No	No
GRASSES				
<i>Agropyron pauciflorum</i>	Yes	Yes	No	No
“ <i>spicatum</i>	Yes	Yes	Yes	No
<i>Agrostis</i> sp.	No	Yes	No	No
<i>Bromus marginatus</i>	Yes	No	No	No
“ sp.	Yes	No	No	Yes
“ <i>tectorum</i>	Yes	Yes	No	No
<i>Danthonia</i> sp.	No	Yes	No	No
<i>Festuca idahoensis</i>	Yes	Yes	No	No
“ sp	No	No	No	Yes
<i>Hordeum nodosum</i>	Yes	No	No	No
“ <i>vulgare</i>	No	Yes	No	No
<i>Oryzopsis hymenoides</i>	No	Yes	Yes	No
<i>Phleum alpinum</i>	Yes	No	No	No
<i>Poa pringlei</i>	Yes	No	No	No
“ <i>scrabrella</i>	Yes	No	No	No
“ sp.	Yes	No	No	Yes
<i>Sitanion Hystrix</i>	Yes	No	No	No
<i>Stipa occidentalis</i>	Yes	No	No	No
GRASSLIKE PLANTS				
<i>Carex douglasii</i>	Yes	No	No	No

¹Based on sight records of actual usage in Oregon.

Disease and Mortality

Disease

The increased number of observers on the ranges as the result of the widespread interest in conservation has provided more practical antelope management data in the past 10 years than in all of the previous century. The former tendency was to embellish the colorful and unusual writings of those who observed game but who were too few to give adequate coverage. The Federal Aid to Wildlife Restoration in the States (Pittman-Robertson) program has been fully justified by the knowledge it has added to numbers, habits, distribution and miscellaneous facts. In spite of this fact accurate antelope mortality records for Oregon are not available. Information is limited and hardly representative, as all losses cannot be observed by the methods now used.

On arid plateaus of the United States, adult antelope bones disintegrate completely in less than 3 years; those of newly-born kids, in less than a year, if unmolested by predators. Those taken by predators provide very little evidence as their bones are soft and even the hoofs may be eaten. This has been observed in several instances during the period of the study.

Ample opportunity to observe bone disintegration on a large scale has existed in great piles of thousands of sheep carcasses left exposed to weather on the high deserts of Oregon as a result of the sheep reduction program during drought years of 1934-35. The process is rapid. In a year's time disintegration is well under way. With the pronghorn, the rapidity of this process, the difficulty of finding carcasses not out in the open, and the vast distances involved, have made it impossible to learn much more about mortality rates than that they are as high. The reasons why they are high has so far eluded the studies of range observers. Skilled man power and funds have been available to investigate every substantial clue to the problem. The veterinary staff of Oregon State College has stood ready to undertake both field

and laboratory work. A group of field workers has been alert to the problem; and yet, during this time, few opportunities to diagnose causes of death have presented themselves.

The animals brought into the laboratory for study have added little knowledge of the specific causes of loss through disease.

Mortality rates change with age. Among kids it appears higher during their early days of life, but because of their size and concealment on kidding grounds, only a few of those which die naturally, or are killed, can be found. The body of a dead adult antelope, on the other hand, can usually be seen, for its white under-pelage is in sharp contrast to desert color patterns and attracts attention at great distances.

Kidding ground losses vary from year to year. In 1937, the loss on observation plots was about 1 kid a section. In 1938, following a severe winter which killed many rabbits, coyotes became very active and aggressive and losses were 2 kids a section on these same grounds. The loss in 1939 was about 1.5 kids a section and in 1940, about 1.6 a section. On observed areas in 1943 and 1944 it was much higher on kidding grounds and averaged about 3 a section in the first month of the kidding season.

During a comparable period, adult antelope deaths by all causes exclusive of hunting were about 1 animal a township. These figures do not include delayed deaths from hunting or illegal kill. Naturally, on such large areas there is no way of knowing the entire loss. It appears to be sizable, however. Many individuals of herds that had not been hunted during the long restoration period in Oregon were old by the time of the first open seasons and died from natural causes.

Occasionally dead antelope of younger age classes are found and it is often impossible to diagnose the cause of death. Old age, however, does account for many of the adult animals which are found dead on the range. Nothing in the nature of an epizootic has been substantiated in Oregon during this study, although there are general rumors that at the

beginning of this century, dead antelope were found over wide areas, and an epizootic may have been prevalent. In 1873, disease of this nature was said to have decimated the pronghorns in the plains states as far west as Yellowstone.

S. G. Jewett, of the former United States Biological Survey, now the Fish and Wildlife Service, reports cases in which antelope were apparently diseased. In Nelson's "Status of the Prong-horned Antelope," 1922-24, he writes (page 46):

"I am sorry to report that a number of fawns have been found dead. Jacobs reports about 20 dead within a radius of 15 miles from old Fort Warner. An old doe was sick near camp while I was there. She acted much like an alkali cow. This condition has probably been brought about by the extreme drought and the fact that the does have not had enough nourishment properly to feed their young. Range conditions are so bad that the big cattle companies have taken all their cattle from that range."

Systematic study of herds has been of such short duration that no actual records of widespread destruction through disease are available, although there are current reports of mortalities. Of recent years in Oregon herds, the presence of "pink-eye" (*Keratitis*) has been noted, apparently of the interstitial type, since the opaqueness finally cleared and normal vision was restored. In several observed cases no fatalities occurred, but since they developed in spring it is believed that bacterial infections may endure winter weather and be transmitted during the winter concentrations.

The mortality rate was found to range from year to year in each herd. Wildlife managers need to be continually alert to such varying trends and consider them in the cropping plan. These experiences accentuate the necessity of periodic inventories. Population trends can thus be determined, and management based upon the harvestable crop.

Conservationists have an opportunity to reduce the possibility of disease by range management. The successful treat-

ment of a diseased wild game species must always be an expensive venture. Wild animals cannot be confined for treatment. For example, the solution to the hoof and mouth disease, problem in the deer herds of California was the destruction of the animals at great cost. Yet whatever the cost, prevention is a more practical course than cure in coping with the problem of sustained game yields. Since the pronghorns do well in small scattered bands, this natural inclination is a safeguard against disease.

Further protection can be assured in the allocation of domestic animal permits. There is little doubt that contagious farm animal diseases are spread more rapidly by large herds living in confinement seasonally, and later taking to the out-range.

Game managers on pronghorn kidding grounds in the arid sections of the West can isolate the highly favored areas. With the grazers' cooperation, deferred grazing can be practiced and thereby reduce disease hazards. On less arid ranges, like those found on mountain plateaus where spring and summer precipitation induces vigorous grass growth, deferred grazing is impractical as the luxuriant ungrazed stands produce a serious fire hazard where lightning storms occur. On refuges the arrangement of the grazing pattern will determine the extent to which pronghorn will be exposed to domestic animal borne diseases and parasites. Autopsies of numerous pronghorns, made in the hunting season, have revealed the animals to be particularly free from parasites in Oregon. Elsewhere, parasites were not commonly found except in areas of concentration or where they shared range heavily grazed by domestic animals.

Predation

If observations of the Research Unit on Oregon ranges are indicative, the coyote is a formidable foe of all age classes of the pronghorn. Although the first weeks of a pronghorn's life may be considered the most critical in this relationship, there is no time when it is safe from attack. This is reflected

in the uneasiness of any band at the approach of a coyote. In large groups the pronghorns seem less fearful of attack, but never do they completely disregard the danger of it.

That their vigilance is warranted is found in the many examples of kill of all age classes. I saw recurring evidence of this, and experiences of other observers are also convincing. Martin Johnson of Corvallis, Oregon, in September 1944, came upon a freshly killed adult doe at Jack Lake, in Lake County, while its meat was still warm to the touch. There was evidence of a struggle and signs that only one coyote killed and feasted upon the body.

Nelson (1925) tells of experiences with bobcats and coyotes and considers them both destructive. He told of a bobcat which stalked a full-grown buck, and killed it by leaping upon its back.

On January 12, 1944, the author, accompanied by the big game survey crew of the Oregon State Game Commission, found a freshly killed 2-point buck in Crooked Creek Valley, also in Lake County. The bobcat was surprised while feeding on the carcass. It had made its kill in a mahogany thicket about 50 feet away, and had dragged the buck over boulders that averaged about 6 feet high to the den area. Such experiences prove that Oregon bobcats do feed on pronghorns and other game of equal size, if the opportunity occurs.

On September 22, 1945, I was camped on a high valley rim, overlooking Guano Creek in Lake County. Near the camp was a runway commonly used by pronghorns, which was bordered on each side by a palisade of enormous boulders and columnar structures. Among the latter were the dens of many desert animals. The remains of a recently killed mature buck antelope were found in a bobcat den about 100 feet from the antelope trail. It is improbable that antelope would naturally frequent this rugged ledge, which blocked approach to the den. Apparently the pronghorn had been killed close by and dragged over the rough terrain to the den.

Obviously, kids could not defend themselves against these

marauders. The alertness of adult antelope usually permits them to close in on predators like coyotes or bobcats, long before the kids are in danger. There are records of several antelope or single does attacking and driving off these animals. This was observed in Oregon in the spring of 1937 by Merle Jacobs, of the Hart Mountain Refuge staff, who watched a doe antelope put to flight a big male coyote stalking her kids.

When winter limits food, the coyotes must be even more aggressive, if, in seasons of plenty when carrion and rodents are abundant, they persist in killing mature pronghorns.

On May 29, 1936, a sheepherder on Spanish Lake, in Lake County, Oregon, pointed out the remains of an antelope kid kill to Research Unit observers. Only the head and two forelegs remained, chewed in a manner characteristics of coyotes. In a few days even these remnants were gone. On June 18, 1937, Merle Jacobs also reported an antelope kid killed near Desert Lake by a coyote.

On June 3, 1943, with a blizzard raging on the slopes of Hart Mountain, I spent an hour watching a large male coyote stalk an antelope kid less than a week old. It was in a basin about $1\frac{1}{2}$ miles southeast of the Refuge headquarters. Several doe pronghorns were scattered around the rim, as is their usual habit. The coyote trotted a circular course on the basin floor, systematically testing the wind with his nose and stopping at many coyote signs. He passed close enough to the observer to permit motion pictures to be taken, but because of the wind, failed to detect his presence. At a distance of about half a mile to the southeast he evidently picked up the scent of a kid, as he began coursing back and forth on a sweeping investigation of a particular area. He would work steadily upwind for awhile, pause and drift back as he apparently lost the scent. The does on the rim became particularly attentive now, although they had never relaxed their vigilance toward the coyote for a moment after he appeared in the basin. Picking up the thread of his hunt again,

the coyote worked forward very slowly, finally pausing to gaze intently at a point apparently several hundred feet away. He crouched and began a stealthy stalk in that direction. The does now became frantic, blowing and racing back and forth on the rim. The coyote was apparently closing in, as he crouched even lower, his body almost invisible against the low grey sage. This last maneuver on the part of the coyote was more than the pronghorns could resist. Two does broke away from the rim, and running neck and neck thundered down the slope, both heading straight as an arrow for the skulking coyote. Through binoculars the coyote loomed, intent on his quarry, unaware of his danger as the does approached from behind. As they rushed into the field of vision the coyote turned to notice them for the first time, and quickly leaped aside to be missed by the narrowest margin. The scene was one of the wildest action. Both does struck several times with their front feet at the leaping coyote, but missed. The kid, which at the time of the first leap of the coyote was less than 15 feet from it, leaped up and ran directly northwest. The does both pressed the coyote hard for about 500 feet as he headed at his fastest speed for the rimrocks, half a mile to the south. Then one of the does dropped back, scanning the basin and the running kid, which again dropped behind a clump of short sage about half a mile from the spot where it first broke cover.

The other pronghorn took the coyote in a dead run into the rimrock and could have easily overtaken it, but her timidity had already overcome her anger and as the coyote reached the protective cover of the big boulders under the rimrock, the doe gradually slackened her pace and finally stopped, drifting back later to join the other doe, and finally working eastward about a mile to a new vantage point.

The coyote, meantime, quickly recovered its composure and drifted out on the basin to renew the hunt. This time, however, he located the human observer and, showing his respect for man, sneaked over into good cover where he un-

doubtedly watched every action as the author attempted to locate the kid. This last hunt took about 2 hours and the outstretched kid was flushed at a distance of 8 feet after numerous trips past the hiding place at even closer distances. The kid, apparently less than 10 days old, was facing north when it arose, but quickly regained its bearing and ran over 2 miles to hide again a short distance from the two restive does who had now been joined by several other anxious pronghorns, all alert to the local danger. As the observer left the range the old coyote was again afoot, working over the ground systematically. Obviously, the first days of a kid's life are fraught with danger from predators.

Sheep men have found it necessary to be continuously alert until lambs are at least 5 months old on these ranges. In a single day a band may lose 8 or 10, sneaked from the herd to satisfy a hungry litter of pups. It is the same wherever coyotes roam. Lamb losses through predation often jeopardize the practice of herding sheep on the grazing lands of the West. It is naive to assume that this predator will graciously extend immunity to the pronghorn kids when guarded only by its kind, for which the coyote has no ingrained fear. Coyotes, uncontrolled, may be a serious limiting factor to kid crops.

The Raven

The raven has proved to be a vicious predator on the ranges where bands of sheep and antelope may be found. Often, in the first few days after birth, lambs may become chilled and inert and are prey to ravens, which attack them and pick out their eyes. Such lambs die quickly. Many which lose only one eye can survive, and in nearly every herd of sheep several of these one-eyed specimens can be seen.

On October 28, 1938, the first day of the hunting season, a doe antelope was killed on Drake's Flat when a herd was fired upon by several hunters. Its right eye was destroyed by ravens in less than an hour after it fell.

Mutilated antelope kids are found each year on the range, but no actual observation of ravens making direct attack on an animal were obtained.

The Eagle

Attacks by the golden eagle upon deer fawns would indicate that it might attack antelope kids on the open range even more readily, although this was not observed. One June 22, 1937, M. Jacobs reported a deer fawn killed by a golden eagle on the peak of Hart Mountain. In October 1940, on Strawberry Mountain, Eugene Starr witnessed an eagle attacking a mature mule deer. It was dislodged from the deer's back as the latter dashed into a mountain mahogany thicket, after being carried by the deer for several hundred feet. The flight of the deer indicated mortal fear of the eagle.

This predator is undoubtedly accountable for losses of antelope kids while they are still small enough for the eagle to handle.

The Coyote

In an analysis of coyote food in Yellowstone Park, from the first of April to about the middle of November in the late thirties, Murie (1940) found that antelope appeared 49 times in the samples. In 17 instances the meat appeared to be from adults, and in 32 from young. According to the findings, antelope in the diet of the coyote in this particular study represented only 00.54 per cent of the total bulk of food. However, this does not indicate the decimating effect of the coyotes on the pronghorn herds. The fact that many of these antelope were undoubtedly killed by coyotes is the important issue, even though only a mouthful of meat may have been taken. There can be little doubt of this as kids, particularly, are known to be at the mercy of the hunting coyote, although some may have died through natural causes and were carrion when taken.

At the time of Murie's study, figures indicated that prob-

ably less than 500 antelope, about 11,000 elk and a large number of deer were using the Yellowstone Park area described in his report. Among the latter two species there had been a high mortality, and carrion was abundant. It is natural, therefore, that the antelope samples should have been limited in amount.

Murie points out in his study that the field mouse (*Microtus* sp.) and the pocket gopher (*Thomomys fuscus fuscus*) are the staple food items of the coyote from April to November, the time covered by this food study, when the antelope should naturally appear in small quantities in stomach analyses unless preferred by this predator.

It is also true that the antelope kids are taken at a time when the coyote can depend entirely upon rodents for food. In the Park, the smaller animals are protected and in the late spring and summer months, the coyote need rely on nothing else. The fact remains that about twice as many antelope kids as adults appeared in the samples. I have seen coyote searching persistently on the Oregon ranges during the first month of the kids' lives. Where remnant herds exist and an increase of numbers is desired, the control of the coyote is obviously necessary. But under normal conditions predation perhaps is rarely a factor in determining survival.

Man

Illegal kills of pronghorns are seasonal. Game officers report that the touring season, when range and desert roads are passable, produces most of these cases. There are a few instances of local residents being cited as violators, but each summer and fall the officers pick up transients who, tempted by the sight of antelope, take a chance. The isolation of the pronghorn ranges often gives a sense of security, also, and people who would not ordinarily yield to such a temptation become lawbreakers. Violations of one kind or another during the fall antelope season when other game seasons are open also account for a considerable number of kills.

The aerial gunnery practice and presence of great numbers of soldiers on maneuvers on the pronghorn ranges of Oregon have had a marked effect on pronghorn abundance and distribution. Their occupancy of the range was both in and out of season. In many instances soldiers were known to have availed themselves of the opportunity for recreation and hunted pronghorns as a pastime in their leisure hours. Although records for 1943 show that less than 700 legal pronghorn kills were reported to the game department, this does not measure the total for that year.

A conservation group known as "The Order of the Antelope" created when the pronghorns were gradually increasing was an aid to the game patrol of the Oregon State Police Department, since, through publicity, they kept before the public the desirability of preserving this species.

An example of local interest in the animal was shown in July 1937, when two young men from California shot a pronghorn on a Lake County ranch. They were tried before a Justice of the Peace at Lakeview, were fined \$200 and as a further deterrent to future violations, the Court sentenced them to a 30-day jail sentence, suspended pending good behavior. This stiff penalty illustrated the local attitude towards protection of pronghorns, a view that might not be applied quite so diligently to other game species.

The surveillance of such vast ranges as the pronghorn inhabit is a permanent task and can be improved by regular observers. Field workers during this study have found such evidence of illegal kills as the remains left in dressing an antelope during closed season. Even in the middle of summer, hides concealed in thick sagebrush tangles have been discovered, proving the difficulty of apprehending all violators of game laws. The shortage of meat under the rationing plan and curtailed patrol during the period of war manpower scarcity, were apparently important factors affecting pronghorn abundance.

Although illegal (uncontrolled) kill may be among the

least destructive of the causes of mortality, it could conceivably increase as the number of travelers to Oregon increases, the state becomes more thickly populated and roads into these ranges improve.

Death on Highways

As deer herds have increased in the various parts of the United States, the loss by accidental death on high-speed highways has been tremendous. Innumerable instances have been reported from Michigan, Wisconsin, Pennsylvania and in the Western States where such highways cut through areas of deer abundance.

On antelope range there are very few such reports and in most of the instances those killed are mature antelope does with kids. When free to follow their natural inclinations, antelope are well able to take care of themselves on a highway. This is because of their running speed, and if they do stop to loiter it is usually at a safe distance from the road. When does are anxious for the welfare of their young they may hesitate and be killed. Research Unit observers reported that a doe antelope was struck down on the Bend-Burns highway near its junction with the Lakeview route in the fall of 1941, while attempting to protect two kids. Generally speaking, these animals are such keen judges of distance and so nimble-footed and alert to danger that they are rarely struck down by onrushing cars.

On the lower-speed roads through antelope country they are rarely seen to cross in front of the lights of an automobile, but along curving roads at night they are often caught in the lights of the cars, standing at a safe distance from the roadway. They are on the alert as soon as they are warned of an approaching car. For these reasons it is believed that antelope numbers can be greatly increased on suitable habitat of the Southwest without the heavy losses common along highways in areas of deer concentration.

In Oregon it has been noticed that when netting fences

closely parallel the right-of-way on both sides of a road and pronghorns are confined to these roadways, they may be struck down by automobiles as they weave back and forth in wild flight. Fortunately, pronghorn range is usually of low value, and the placing of roadside fences at distances of 100 feet or more from the pavement will reduce the hazard to a minimum on well-stocked pronghorn ranges. If these fences can be designed to allow 12 to 18 inches clearance from the ground, the pronghorns will pass through with hardly a pause.

Accidental Deaths

Antelope have a tendency to gather in large bands during the winter months. This practice endangers the herds. A severe snowstorm may destroy their ability to travel; the risk of death from predators is then increased, as they are unable to protect themselves; and large herds are also more susceptible to disease. Undoubtedly, the rapid decimation of antelope which seems to have occurred during the past hundred years has been facilitated by their herding habit. Time after time it has been observed that antelope in winter concentrations will lie so close together that there is no apparent room between them. Mild winter weather is no detriment to the rapid spread of bacteria from one individual to another, and the ultimate infection of the entire herd may occur.

There are a few records of accidental pronghorn deaths. the *Pittman-Robertson Quarterly* for October 1943, page 200, reporting on South Dakota big game studies, carries this statement:

"Large numbers of dead antelope were counted during the census. Death was ascribed to a severe storm during the week of March 16, during which the animals died of suffocation. From 500 to 1,000 antelope were estimated to have died during this storm in which domestic livestock losses were also heavy."

On June 8, 1943, a range rider in Guano Valley reported

14 antelope dead in the mud on Lower Guano as a result of being mired down. Antelope are often startled and rush wildly into such a trap, although usually careful to avoid soft mud or quicksand.

A similar accident occurred in the same area in 1939 when 18 pronghorns were lost.

In 1944, the newspapers of the Northwest carried the following item indicating that in the past, losses of considerable proportion may have occurred which exerted a marked effect on pronghorn populations without being recognized.

100 ANTELOPE KILLED IN PLUNGE OVER BLUFF

Cheyenne, Wyo., March 1.-(AP) — The Wyoming Game and Fish department reported today 100 antelope were found dead in southern Campbell county at the base of a 45-foot bluff from which they apparently had dropped.

The piled and broken bodies of the pronghorns indicated they had plunged from the top of the bluff and the game and fish department is attempting to determine what caused them to go over it.

Officials theorized the antelope may have been blinded by a storm and went off the edge of the bluff or that they may have been frightened by an airplane and jumped from it. The area where the bodies were found is virtually inaccessible to automobiles, they said.

A stampede might also destroy a great herd if it is suddenly frightened. The unfortunate habit of the animals to follow a leader is a handicap, since any menace is ignored even during the hunting season. So long as the group leader follows a definite path, the pronghorns which have foraged together seldom separate, and will stubbornly follow a course which may lead to their destruction. This tendency to stampede is illustrated in the newspaper item under date of March 1, 1944, which reported the death of 100 antelope which had plunged over a cliff in Wyoming.

Death from Old Age

Although available information is inconclusive, the pronghorn antelope appears to have a relatively short life, and

if herds have been protected it is logical to suppose that death from natural causes will result. Often the condition of a desiccated carcass indicates senile decay. The teeth may be "pegged" or even gone, the body emaciated and the pelage rough.

A. V. Meyers, working on Guano Creek on July 1937, found a dead doe which had been reported a week earlier by Ed Calderwood, a rancher, as being slow, weak and in poor physical condition generally. When examined she showed every evidence, including peg teeth, of having died of old age.

In June 1938, an old buck was noticed in the vicinity of a spring on a steeply sloping hillside above Guano Meadow in Lake County. He moved with effort, stayed by himself, and became progressively more feeble as the summer advanced. On October 29, a dead buck was found in the same area. Examination disclosed evidence of senile decay. There were no areas of injury or lesions. The lungs were apparently free from irritation of any kind, and, although the stomach and intestines were only partially filled with food, no parasites were discovered. The buck was almost without teeth and in poor flesh, weighing about 80 pounds.

Complete coverage of the antelope range would probably produce many similar records, but continuity in observing a single animal is seldom practical and so pronghorn deaths may often be classified as due to predation or disease, when actually they are due to natural causes.

Life History

Mating

Perhaps the most orderly family life of the pronghorn antelope is in the summer as the water supply on the range becomes limited and they drift to remaining water-holes in great numbers. No deference is shown the more mature animals because of their age or tribal position, and all seem in complete harmony. This is most noticeable throughout July; but in early or mid-August a restlessness

can be noticed among the adult males. Soon, this communal relationship is broken by the first droll antics of the bucks. The first manifestation is in odd poses. A buck may stand languidly, like an over-mature horse with his head down in the last stages of physical decline and deep melancholia. Suddenly the rump patch or rosette will appear whiter than usual, and well defined against the darker coloration of the animal. On close inspection it will be noticed that every hair is erect, and by the twitching of the skin a continuous motion of these hairs is maintained. Often it will be accompanied by the raising of the black hairs of the mane and the animal may hurriedly jump aside, as though avoiding the strike of a rattlesnake.

Many people when first noticing these physical reactions at the beginning of the mating season, are confused and reports of "locoed" antelope or weird tales of fights with predators are heard. This behavior begins in Oregon as early as August 10. If the dry season has not forced all the pronghorns to a common range a single buck may be noticed standing alone, miles from his nearest neighbor, and as you watch he may pass through one of these unpredictable "spells." Or, on well-populated pronghorn range, a buck striking such odd poses at once becomes the wonder of the entire herd, and he arouses among his fellows about the same degree of concern as a man having an epileptic fit on a city street. But this curiosity passes as other mature bucks become affected similarly.

Although at first the does show no interest in this behavior, the bucks work to drive them into personal flocks or harems of perhaps as many as 15, guarding them with a jealousy toward other bucks that amounts to a mania. Clouds of dust appear irregularly on the dry lake beds during this season, reflecting the wild activity of the herd. As the season progresses, a group may dwindle to 7 to 8 does. The collection of harems is not a common breeding characteristic among big game animals, with the possible exception of the elk, but is true of a very dissimilar animal, the fur seal.

Normally, the antelope's eyes protrude like a crustacean's. When angered during the breeding season by the approach of a rival to his harem, a buck bulges his eyes even more. This gives him a most ferocious appearance. Before the onset of the mating season in August, the bucks are in the best physical condition. Then the meat of specimens is slightly marbled with fat. This is rarely so during the hunting seasons of the West, usually held in September or October, when the meat is muscular and lean. As will be discussed later (Page 193) it would appear wiser to open the hunting season before the rut, if killing is to be limited to buck kills only. If reductions are to be made in a herd by killing does as well as bucks, the hunting season should be in late September when the kids are self-sufficient. By August 20 the mating season is in full sway, continuing intensively for 15 to 20 days, with few records in Oregon after September 20.

Ten to fifteen days may cover the period in which 90 per cent of the kids are born. This fact is of tremendous importance in pronghorn management. If the species had a wide breeding range, and the kids were born over a period of several months in late spring or early summer, there would not need to be much concern over survival, since at least some of those born would face good weather conditions. However, owing to the short period in which the young are born, inclement weather, excessive predation or perhaps disease could reduce them to a remnant, and even completely eliminate one age class. In recognition of this fact, any harvest must be based upon a knowledge of the size of the crop.

A preponderance of does is obviously less critical among polygamous than monogamous species, and in those where bucks collect a harem it is naturally less important. Hunters often report a scarcity of bucks, but rarely is it dangerous as they believe; for doe deer are seldom unfertilized even when bucks are scarce. At Cow Creek, Oregon, in 1938 in a captive herd of 18 doe deer and 1 buck, each doe produced one or more fawns.

Most antelope does are bred when little more than a year old. Does born in May will mate in August or September of the following year, when 15 or 16 months old. It is doubtful if pronghorns live more than 6 or 7 years, although the exceptional animal may reach 8 to 10 years. In captive or semi-captive state, pronghorns usually die in a year or two, and rarely exceed 5 years, even on enclosed range comparable to their usual habitat. They are obviously animals of short life span, but even does of grizzled appearance with "peg" teeth, which are a sign of old age, will give birth to young. This has been observed by Research Unit personnel as well as other field workers. A doe of this age class collected on Drake's Flat January 27, 1941, carried fetuses. The mating of all fully developed, healthy animals each year is apparently accomplished regardless of age.

The varying doe-kid ratio each spring creates some doubt as to the fruitfulness of matings. A similar condition has been reported in other pronghorn localities. I believe that if matings are unsuccessful, and an ovum fails to develop, then a second period of oestrus does not occur in the female. In domestic animals like the cow, on the other hand, periods of oestrus follow failure in fertilization, and this accounts for the fluctuations in calf drop during the year. This has not been observed among antelope, which nature has apparently limited to one short mating period yearly. Indeed, the complicated courtship pattern, with accompanying change in habits and physiology that must occur in the animal, could hardly be repeated several times in a season. No doubt intense activity of the mating season puts a tremendous strain on the body vigor in both sexes.

From my observation I believe that the gestation period is about 230 to 240 days. This conforms generally to the records of observers on other ranges, although no zoological garden or laboratory records offer explicit data. Rush (1944) says: "The period before birth is 8 months, a full month longer than deer and 3 months longer than sheep or goats.

Most of the hollow-horned grass-eating mammals, however, have a gestation period of 9 months." There is little change in appearance of the pregnant doe as the time of delivery draws near, when they restlessly seek the isolation of the kidding ground.

Charles J. Beldon of Pitchfork, Wyoming, comments in a letter written February 22, 1941, as follows:

"I cannot tell you exactly the average period of gestation of the antelope, but I do know that they breed about the first of October and fawns are dropped from the 5th to the 15th of June. I should judge that in our herd of three thousand head, that 90% of the fawns are dropped in this ten day period."

Choice of Kidding Ground

From observations I believe that two factors determine the choice of antelope kidding grounds: suitable terrain and proper vegetative height. A ground most satisfactory to antelope is a type of basin surrounded by a low ridge of hills, where the vegetative stand usually averages 9 to 18 inches. The low ground cover affords protection for kids by permitting the does to observe the whereabouts of their young at all times, and provides ideal camouflage.

Doe antelope do not spend much time with their kids, but during their absence localize themselves at some vantage point where they can watch the terrain. They find this easier in the basin or bowl type of ground, as it allows them to see the approach of predators or other menaces, and a downhill start permits them more rapidly to reach the hiding place of their young. An antelope doe a half-mile from her kids can reach them in 45 seconds by traveling at a speed of 40 miles an hour. Although the choice is not entirely consistent, doe antelope usually select land that is not intersected by deep gulleys or crooked ravines. I believe many attempts at stocking range have failed because of poorly chosen kidding ground. Pasture grasses and herbage are often limited, as the areas are not the choicest feeding spots.

Several exceptions on the Malheur Refuge have been reported by Clarence A. Sooter, Biologist of the United States Fish and Wildlife Service, whose letter on the subject follows:

"A pair of antelope kids, not more than a week old, were noted on a small island near the north end of Unit 8 (Little Sagebrush Field on the Malheur Refuge) the latter part of May, 1938. The island was completely surrounded by water 2 to 12 feet deep and supported a fair stand of greasewood, sage and yellowbrush, about 3 to 4 feet tall, a sparse carpet of saltgrass, and weeds were also present.

"On June 7, 1940, two additional antelope kids were noted on islands in the House Field of Unit 8. These animals were approximately 2 to 3 weeks old. The first of these was noted on an island about 250 to 350 yards north of the gate opening on the Buena Vista pond dike road. The vegetation on the first island consisted of *Elymus condensatus* in scattered clumps about 5 to 6 feet tall, some sparse greasewood, about 3 to 4 feet tall, and one or two clumps of roses near the center of the island. There was also a fairly heavy stand of *Carex* sp. and *Elymus triticoides*, 1 to 3 feet tall, around the edge of the island. A moderate to sparse stand of saltgrass and short *Carex* sp. was also on the center portion of the island. The island was surrounded by water 2 to 3 feet deep.

"The second kid was noted the same day on an island approximately 75 yards southeast of the island containing the first kid. It also was surrounded by water 2 to 3 feet deep. Vegetation on this island consisted mainly of a few clumps of *Elymus condensatus*. Scattered over the island there was a heavy stand of *Carex* and *Elymus triticoides* at the water's edge, a moderate size clump of roses on one side of the island, and a sparse stand of grass, *Carex* sp. and weeds over the central part of the island."

Observe that Sooter states these kids were from several days to several weeks old at the time of observation. No

definite information is available to prove the birth date of the antelope on these islands. It is apparent from the number of records available that this is not a natural kidding site. The fact that the area is on unmolested territory in a refuge may account for the choice. With the increasing numbers of adult antelope using the tract, it would appear that if this choice of kidding ground were preferable, a greater number of kids would be born there, since 10 to 40 antelope were consistently seen on or near the refuge and larger herds are found nearby. The selection of islands as safety cover from the numerous coyotes using these meadows appears to be more than an accidental choice by the does.

Man's activities have influenced the habits of most game species. The pronghorn is no exception, but fortunately pronghorn range in Oregon is sparsely settled by humans. Range fences do not comprise the problem that they do in Texas, for instance, as indicated in the following letter from A. R. Williams, Game Warden of the Game, Fish and Oyster Commission of Texas, dated June 13, 1943:

"In the old days, before there were fences to stop the antelope, they ranged on the grassy plains during most of the year. Then when they went to bear their young, they moved to the rolling hills where they could hide their young better, in the rocky ridges and among the Spanish dagger, Yucca and tree cactus and other types of brush.

"In the Trans-Pecos District the antelope used the grease-wood flats for kidding ground sometimes. They come back to the same range every year to kid if fences do not check them, except during a very dry year. Then they will go where there has been some rain and the weeds are green if fences permit.

"The net wire fences are causing the antelope to change their habits some, like having to range and kid in the same area."

As the kidding season approaches, the doe antelope appear to drift toward the type of range they find most suitable



Figure 18. Typical kidding ground, central Oregon plains country.



Figure 19. This range, ideal for kidding, has ground cover less than a foot in height. Photographs by author.



Figure 20. A day-old kid. Photograph by William Graf.



Figure 21. Resting in the newly found "hideout." Ringlets and dappled appearance of coat evident. Photograph by author.



Figure 22. Antelope kid, one day old. Photograph by William L. Finley, U. S. Fish and Wildlife Service.



Figure 23. Pronghorn kid one day old, with hair now lying more smoothly,
but with ringlets on the back. Photograph by William Graf.



Figure 24. Twin kids hiding. Photograph by William Graf.



Figure 25. Doe kid. Note exceptional size of eyes, typical of young pronghorns. Photograph by William Graf.



Figure 26. Antelope kid about a month old. Photograph by William and Irene Finley.



Figure 27. Day-old kid, just gathered from the kidding range.
Photograph by William Graf.



Figure 28. Three and one-half month old antelope, showing horns starting. Reno, Nevada. U. S. Fish and Wildlife Service Photograph.

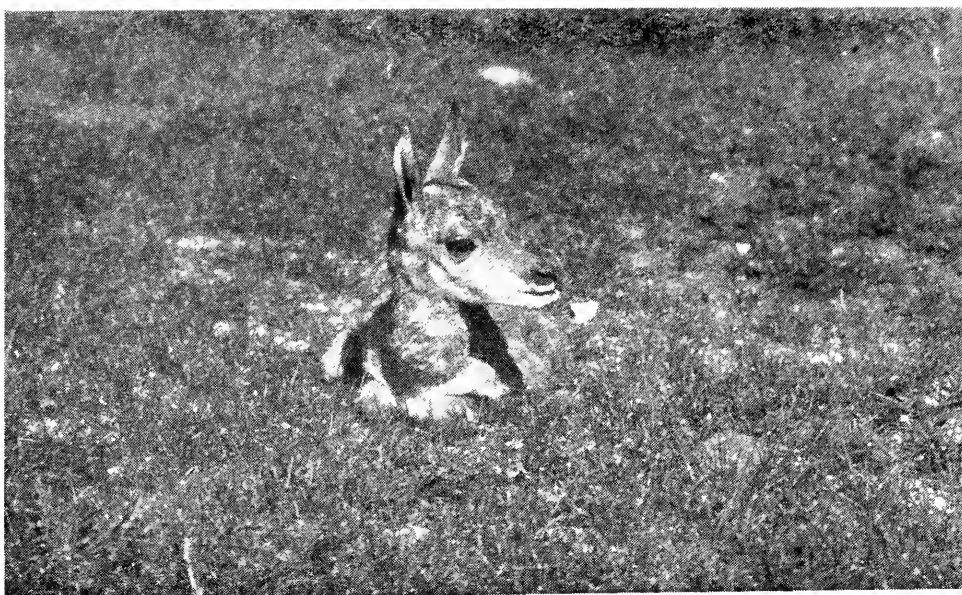


Figure 29. Very young antelope. Note protective coloring.

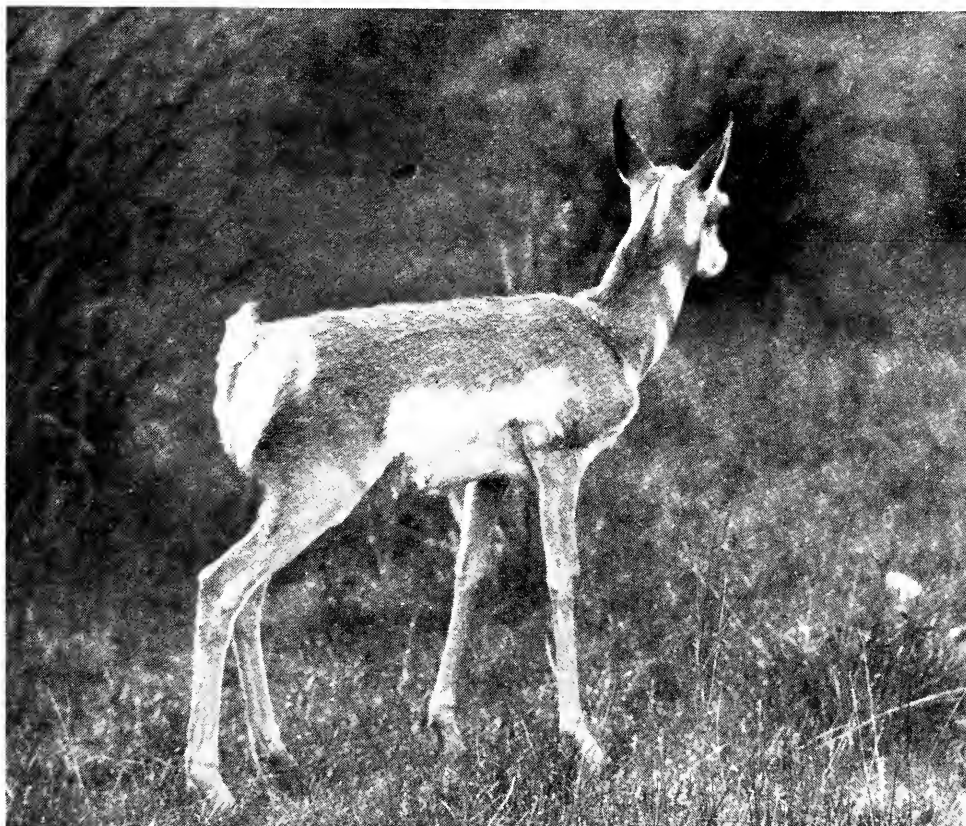


Figure 30. The same antelope at about three months of age. Note changed marking. Photographs by S. T. Woodring.



Figure 31. Ten-day-old pronghorn still has wavy hair. Photograph by John McKean.

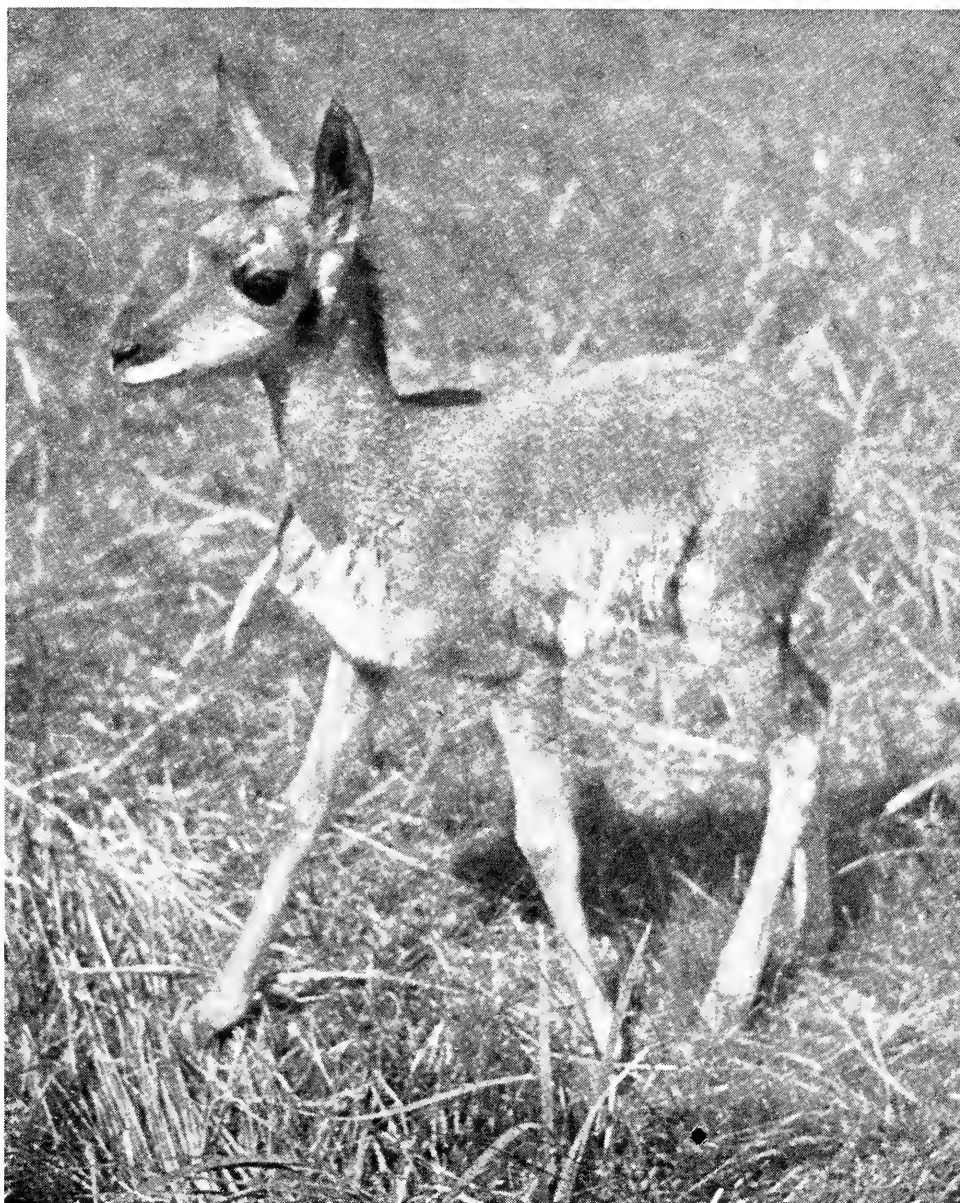


Figure 32. Typical pose of playing kid. Photograph by Eugene C. Starr.



Figure 33. Curiosity brings this kid to the camera.
Photograph by Eugene C. Starr.

for that purpose. There they gather some time before the kidding date and there they remain until the kids have matured enough to travel easily. In Oregon this is usually early in July. The change is gradual and an area which has a heavy concentration of gravid animals in the middle of May, may have a very small number foraging there later in the summer. For that reason an inventory of such a range may give an erroneous impression of what will probably be found later in the season. Portions of habitat well stocked in May or June will perhaps be barren in October. Other portions of the range where water is abundant may carry concentrations over a wide area, but even this number may be small when compared with counts made earlier in the season. Other favored spots may be carrying the herd which has drifted to another range through seasonal influence. From our knowledge of pronghorn habits the grazing and kidding grounds do not appear to have identical physical properties.

Kidding

The kidding season in southeastern Oregon begins about the middle of May, and is very short, the majority of the drop coming between May 20 and May 27. This appears to be much later than in some other sections of the country. Texas reports, "The first fawn was observed February 23, and females with fawns were common by March 10."

Kidding time is obviously not influenced by weather, as the breeding season approximately 8 months earlier fixes the date of drop. It often comes when late blizzards or cold rainstorms prevail, in which event the loss of newly-born kids is great. In 1937, cold, sleety weather on parts of the Oregon antelope range near Silver Lake took a heavy toll. During the ensuing summer dead kids were found often enough to indicate serious losses. Such a late storm has a direct effect upon populations.

In 1943, the weather on kidding range was extremely stormy until about June 10. Inclement weather always

favors the coyote and in that year their depredations were unceasing. Kid survival was perhaps the lowest in any year since this study began. Even the hunters noticed the kid scarcity in the fall hunting season in late September. In 1944, the kidding season was followed by a stormy period. Although the storms were late in the spring, they evidently destroyed kids, and also other species; for example, whole flocks of newly-shorn sheep perished when 10 inches of wet snow fell in Lake County on June 10, 1944.

Obviously, kids born in cold and stormy weather have little chance of survival. At birth, when life clings feebly, wet or cold weather may delay drying and cause death. Several kids have been found each summer in a mummified condition, stretched out in poses characteristic of their first days of life. Naturally, the cause of death could not be precisely diagnosed at that late date, but it was obvious that they were not predatory kills, and the body development indicated death shortly after birth.

In the vastness of the range, few such kid remains were found in comparison to the total population of antelope occupying the area, but enough were seen to substantiate the belief that they had perished from exposure. In years when critical stormy weather prevailed at kidding time, survival was obviously low. In 1944, following an unusually stormy kidding period, a 1-day census conducted in midsummer on several Lake County pronghorn ranges indicated that less than 5 per cent of the total antelope population were kids of the year. In years of better weather conditions, such as in 1937, east of Abert Rim the ratio between does and kids was 1:1.08, an extremely high figure.

When a doe approaches her time of delivery she seeks the isolation already described and lies down. If she gives birth to a single kid she may dry it and walk slowly away to stand at a distance. Rarely does the entire act of delivery take more than an hour. She then takes up her vigil from a fourth to a half mile away.

Twin kids are not usually dropped in the same cover, but may be separated by 50 to 400 feet. Birth may be at any time of day or night, though from field records more births occurred in the forenoon than at other times. When twins were born, one might be as much as an hour older than the other. In each case drying was hastened by the doe licking her young, working from the head toward the rear quarters. This accentuates the wavy ringlets of the kid and as they dry a perfect example of beauty parlor wave set results. Shortly after the kids are born they are left to sleep until molested either by the doe or an intruder. When awakened after drying, a kid will awkwardly rise to its feet, sway drunkenly, shaking its head and blowing weakly through wet nostrils. At such times they were not seen nursing. There is little activity the first day. The mother is nearby and though she shows no tendency to run, she is very alert to any intrusion that might affect her young. And in an emergency she will run as actively as before.

Antelope kids are interested in anyone who comes near them within a few minutes after birth. They apparently have no sense of fear and are anxious to receive any attention for the first 24 hours, before they react to scents. The kids are articulate from birth and their call is similar to that made by placing a single blade of grass between two thumbs and blowing between cupped hands. The note is high-pitched and quavering and lasts for but a second. The kid does not noticeably open its mouth and seems to throw its voice like a ventriloquist. Usually one looks twice to see if a second kid is somewhere near. The call, however, has the effect of reaching most adult antelope within a distance of at least 500 yards; for bucks and does all become restless and rush frantically here and there, showing great anxiety, although apparently unwilling to cope with the situation if the disturbance is the result of man's interference.

During this study, when many kids were handled, there was no time when the author was endangered by attacks

from enraged parents, although they always showed this same restlessness and anxiety and would dash by at close range. Never did they show anything but anxiety, however, and apparently came in close to take a hasty look rather than to offer protection to the kids.

Even after repeated visits to the young in one day, the adult antelope would not relax or become accustomed to the menace endangering their offspring. The handling of newly born kids did not cause their mothers to abandon them as people commonly suppose.

Development of Kids

The behavior of pronghorn kids changes remarkably during a comparatively short time after birth. Development is about as follows:

First day. Very wobbly on their legs, weak in the leg muscles. Do not stand erect but crouched. Legs bent and not perpendicular under body. Lie with heads outstretched on the ground, blending well with the earth, rock and vegetation. The wavy pattern of their pelage increases this illusion. Hearing and smell not developed. Kids anxious to nurse and will find a fold in the observer's clothes, the top of his boot or will go into raptures over a chance to suckle a little finger. The fact that no nourishment is obtained leaves no impression upon them. They are as anxious to continue the process as though they had assurance that the next good draft would produce the desired results.

As soon after birth as they are dry, the kid's hair lies in beautiful waves all over its body. Although it is not curly and kinky as on the lambs of domestic sheep, it has a dappled, wavy appearance of indescribable beauty.

Second day. Run awkwardly and can be outrun by humans.

Third day. Very hard to catch. Smelling and hearing developing rapidly and great change in posture of the body noticeable. More timid.

Fourth day. Cannot be caught by man, but still running awkwardly.

Fifth day. Show evidence of a synchronized gait, and approach somewhat the running rhythm of the adults.

Sixth day. Now running smoothly and restlessly. Up to this time the rump patch has a yellowish or lemon cast and has not been so noticeable, but after a full week or 10 days the rump patch becomes glossy white. At this age the average dog can barely overtake them when they are in flight.

From this time on the antelope kids enjoy playing with each other like kids of domestic goats. They travel with their mothers, although they still drop out of sight and hide in the short sage when they have gone a considerable distance from their molesters or become fatigued. They will lie close until approached, when they will hasten away at break-neck speed with rump patches flashing. During this period the rump patch is more accentuated than in the adult, since it seems to form a flange overlapping the general contours of the body, out of proportion to the kid's size.

During the first months of the kid's life it will take flight, and with a burst of speed pass its mother, glancing back occasionally to see that its bearing is roughly on her course. It will continue this pace until, either feeling the need for rest or safety in hiding, it will drop down, stretch its neck along the ground, blending into the surrounding scenery. When they are in flight from enemies, the mother protects them by flanking them; and when they drop down, she marks and remembers their hiding place as she continues on her course from the kids.

Nursing and Rearing

Antelope kids nurse at irregular intervals and for short lengths of time. They have been observed to nurse 5 to 15 times each 24 hours, during the night as well as the day. From a half to one and a half minutes is the customary

nursing period, which suggests that the mother's udder must contain a limited amount of milk. This is substantiated by record. In May-1940, an antelope doe that had gone un-nursed for a 20-hour period, was taken as a research specimen. Her milk supply amounted to 6 ounces.

This milk was analyzed by J. R. Haag, Nutritional Chemist of the Agricultural Experiment Station, Oregon State College. A comparison has been made with milk of several other mammals.

Analysis of Milk			
	<i>Antelope*</i>	<i>Cows</i>	<i>Evaporated</i>
Total Solids	24.9	12.8	26.5
Fats	13.0	3.7	8.2
Protein	6.9	3.5	6.7
Lactose	4.0	4.9	10.1
Ash	1.3	.7	1.5

*Haag's Analysis

It is obvious that antelope milk is extremely rich compared to cow's milk. During this study no attempt has been made to work out a formula for feeding antelope kids, but two obvious facts are apparent from the analysis. First, since the milk is very rich, the common practice of using domestic cow's milk for feeding antelope kids is not satisfactory. Even goat's milk is not so nutritious. Second, since the daily total accumulation of milk in an antelope doe is of such small volume, extremely small feedings at frequent intervals should be given immature antelope. Although antelope's milk compares with undiluted condensed or evaporated milk in total solids, it has a much lower sugar content. At the Charles Sheldon Refuge, pronghorn kids raised for restocking were fed supplemental portions of sugar added to cow's milk. Antelope kids should be fed both night and day, if their natural habits are to be followed, and, in the early days of their life should have at least five feedings in a 24-hour period.

William Anderson, in charge of the Hart Mountain Na-

tional Wildlife Refuge in 1945, has written the following interesting account of his experiences in raising pronghorn kids. The report, made available by Fish and Wildlife Service should be helpful to anyone needing guidance on this subject.

"In early May, 1945, well before fawning season, an enclosure was constructed, providing a space about 120 x 150 feet which later proved entirely adequate for the fawns. In one corner of this enclosure a retaining pen was built for confining the fawns for a day or two while excessively wild. This was later used to protect them from stormy weather which prevailed for several weeks after they were gathered.

"A number of 9 ounce nursing bottles with nipples and a supply of evaporated milk were procured, and on the advice of a Lakeview, Oregon, physician, codliver oil was used as a substitute for butter-fat in consideration of the fact that antelope milk has a considerably higher fat content than ordinary commercial evaporated milk . . .

"Does in the field were watched closely after May 13 when it became apparent that the drop might begin any day. The present scarcity of antelopes made it particularly urgent that we be on the grounds during the peak of this drop, which might be completed within a matter of 2 or 3 days. Cat Butte, near the southern boundary, at first looked fairly promising as a point of vantage, but the majority of antelopes seemed to move out of this territory, and all but three fawns were gathered within 5 miles of refuge headquarters.

Response of Kids to Human Handling

"The collecting of antelope fawns is best accomplished before they are more than 3 or 4 days old, after which time they are likely to get up and run when anyone approaches. We selected various vantage points in fawning territories where the observer would hide behind rocks or junipers. A tremendous amount of patience was required as well as a good deal of hardihood because of prevailing inclement

weather. Sometimes it was necessary to wait several hours before a doe was spotted in the distance, cautiously approaching the place where her young was lying, obediently motionless. The observer would then wait until the nursing had taken place, carefully mark the spot where the fawn had been last seen and walk to that spot.

"In spite of the fact that the fawn was . . . on open and sparsely vegetative range it was so protectively colored that it was often amazingly difficult to locate it. When this was done by moving slowly and deliberately, it was then possible to grasp the animal gently but firmly by the back of the neck. A burlap bag proved quite adequate for confining the fawn till it reached the temporary shelter. Needless to say, we made it a point to get the fawns back to headquarters as quickly as possible.

"When a fawn is being picked up on the open plain it will bleat loudly, especially if it is a few days old. This is generally repeated each time it is handled until it has become accustomed to its caretakers, and to the nursing bottle. Persuading the fawns to accept the nipple and bottle seems to be a matter merely of time and patience. None of them were willing to eat on the day that they were brought in but all started to suck sometime during the second day. Hunger plus the natural nursing impulse sooner or later overcame timidity.

"The length of time required to gentle an antelope fawn to the point where it can be handled without a struggle depends upon the individual fawn. One of our animals was more confiding within a few hours than most domestic stock, while some of the others forgot their native caution only after several days. In order to get the more timid individuals gentle enough so that we would not have to corner them or run them down at feeding time it was our experience that association with those already gentle had a far better influence on the others than close confinement. This theory was carried to the extreme of allowing the difficult

ones to accompany the pets through the open gate for daily exercise. When thus outside their more familiar environs they appeared to demonstrate to some degree a measure of dependence upon their caretakers. At length all of the animals became increasingly fearless of motor vehicles, domestic stock and unfamiliar objects as well as of human beings.

"The instinct to nurse after the fashion which nature intended was so strong that some of the young fawns would regularly attempt to suck others. This became somewhat of a nuisance during the time it was most prevalent and may very well have been caused partly by faulty diet.

". . . the fawns were all permitted to roam the 15 to 20 acre headquarters area during a part of the day after they were about three weeks old. Soon they became thoroughly familiar with the grounds, and by August 1 it was believed entirely safe to leave the gate of their enclosure open at all times so that the woven wire fence around the entire area was thenceforth the only limitation of their freedom.

Feeding

Antelope kids begin to show interest in ground forage as early as one week after birth. There seems to be no attempt to satisfy hunger, as they merely sample a little here and there. In the aggregate this probably amounts to only a few wisps, but the amount increases daily, and by the time they are 3 weeks old, they are feeding in a desultory manner. From that time on the increase in the solid food taken daily is very marked, and in Oregon, nursing is usually discontinued by the end of August, or becomes of little importance as a source of food. When solid foods become a substantial part of the daily diet growth is accelerated and by early fall kids of the year are indistinguishable to the novice from 2-year does.

"In arriving at a feeding formula for the captive antelope fawns, the 1940 project again was a major influence, and various helpful suggestions were derived from an article in *Journal of Wildlife Management*, October, 1942: *Gather-*

ing, Transplanting and Care of Young Antelopes by A. A. Nichol. The feeding formula used in the beginning: 14 ounces evaporated milk, $1\frac{1}{2}$ ounce tap water, 2 teaspoons codliver oil. Ration, 2 ounces per animal, per meal, 5 meals per day (6 A.M., 10 A.M., 2 P.M., 6 P.M., 10 P.M.). On May 23, codliver oil was reduced to one-half the original amount. Ration gradually increased so that the first arrived pair was getting 4 ounces per feeding on May 24.

"Digestive disorders were noted on May 27 in two of the fawns and rapidly appeared in all. As it was thought that the almost pure evaporated milk might be too rich, tap water was increased to 3 ounces in the formula.

"On May 31, acidolphelus milk was added and the formula radically changed as follows: 28 ounces evaporated milk, 9 ounces acidolphelus milk, 9 ounces lime water, 2 teaspoons codliver oil. By this time individual rations varied from $3\frac{1}{2}$ to $4\frac{1}{2}$ ounces according to size and strength of animals, whose condition had become quite desperate. Prevailing symptoms of their digestive and intestinal disorders were chronic diarrhea, constant straining and passing of mucous and blood. Their appetites were enormous, considering their condition.

"On June 2, Veterinarian Bradley of Lakeview was consulted. Sulfathaladine was prescribed by him and administered June 3, 4, and 5. The formula was changed to the following proportions: 1 part boiled water, 3 parts evaporated milk, $\frac{1}{4}$ tablet sulfathaladine. Ration per animal $2\frac{1}{2}$ ounces each, 4 times daily. The condition of the fawns showed great and immediate improvement after 3 or 4 doses. However, occasional recurrences were experienced and one or two cases seemed particularly stubborn. Consequently sulfathaladine was administered periodically whenever the occasion seemed to demand it. In the meantime individual rations were increased up to $3\frac{1}{2}$ ounces of evaporated milk diluted with $1\frac{1}{2}$ ounces of tap water by June 10.

"Thus far we had managed to keep the animals alive but

they had failed to grow and develop according to expectations. A new experiment was initiated June 22, when fresh cows' milk was added to the condensed milk. The ration was gradually increased until each fawn a few days later was receiving 9 ounces of liquid per meal: $3\frac{1}{2}$ to 4 ounces of evaporated milk, the balance of fresh milk. It is interesting to note that bowel disorders disappeared at this juncture and a gratifying increase in growth followed.

"As early as May 26 calf meal and bone meal were provided. Some of the fawns began to eat the calf meal to a limited extent a few days later. Calf manna, rolled oats and barley were made available after a couple of weeks. Yet, it was not until about July 1 that *all* of the fawns were seen to take advantage of the dry feed. We cannot be certain whether or not the bone meal has been used at all. The oats and barley were preferred to any other concentrate and eaten greedily once the fawns got a taste of it.

"When approximately 3 weeks old, the fawns began to nibble on vegetation, doing this to an increasing degree as time went on, and though they showed certain preferences (for instance dandelions, dwarf evening primrose and certain grasses) they probably tasted every plant species growing on these premises.

"The need of drinking water while the animals were on a liquid diet, was obviously not very great during cool, damp weather. Water was provided, however, and used to a limited extent. Since the second week in June they had ample opportunity to drink out of Rock Creek and seemed to do so once or twice daily.

Growth and Development

"At birth antelopes are said to weigh from four to five and a quarter pounds. It is presumed that these fawns averaged three days old at the time of capture. On June 21 their weight averaged 10 to 12 pounds.

"For convenience in reference, each animal was named. For the same reason these names will be used in this weight

table and in the following discussion on losses and ailments. The weight is given in pounds below.

<i>Date</i>	<i>Vera</i>	<i>Ida</i>	<i>Tim</i>	<i>Bozo</i>	<i>Banjo</i>	<i>Mousie</i>	<i>Eddie</i>	<i>Blondie</i>
7/13	21	26	25	24	23	23½	20	20½
7/30	29	30	34	34	32	34	30	27
8/14	38	36	46	46	42	40	x	36
8/26	49	47	55	54	51	52	x	47

Losses

"One fawn which died on May 26 had only been in our possession 1 or 2 days. Cause of death unknown. It was found in the morning with legs outstretched, neck curved back over shoulder. It lived for an hour or so after we found it.

"On August 2, a fine young buck (Eddie) began to show slight sluggishness. From being one of the most active of all and apparently healthy in every respect he suddenly ceased to join the others in play. This became particularly noticeable the evening of August 3. The following morning he was lying in a position similar to that described in our May 26 casualty. He lived for about 2 days during which time he remained in a prostrate position, struggling spasmodically. A serum (subcutaneous injections twice daily of antistreptococcus) was tried in accordance with Mr. Bradley's advice, but death occurred early August 6.

"It was noticed on August 31 that the finest animal in our band, a buck which we called Tim, was ailing and by the following day it was apparent that we had another case similar to the preceding. On September 2 he was down part of the time and refused to eat. It was then decided to make an attempt to transport him to Corvallis for treatment or autopsy. We managed to get the fawn to Corvallis alive. He was taken to the laboratory of the Department of Veterinary Medicine at the State College and given an intravenous injection of 20 cc calcium magnesium by Dr. H. Muth, on the assumption that the trouble had arisen from a nutrient deficiency.

"The following morning the fawn was still living. Indeed, it was even persuaded to take 4 ounces of milk. Nevertheless,

it died during the next night. An autopsy was made and although the causative organism was not isolated, Dr. Muth believed it was a disease which occurs among domestic lambs, and suggested "a dose of toxoid" as a preventive in the event of another fawn project.

Ailments

"Aside from the troubles experienced from infectious bowel and intestinal disorders, which were ultimately checked, there were two cases of accidental injuries and one case where a fawn was taken ill but later recovered.

On June 30, one of the fawns, Blondie, suffered a broken right frontleg, the fracture being about midway between ankle and knee. The accident was not witnessed by anyone. An attempt was made to splint the injured leg. However, on July 2 it was evident that no healing processes had begun. The leg was then bandaged and tied up close to the body in a sort of sling, but when released more than a week later the bone had not started to knit and it was not rebandaged but left fully exposed in order to at least prevent injury to the badly swollen knee-joint which had been bent at an extremely sharp angle. It was most surprising to all, then, when in a week or so the fawn began to use the leg. The fact is that recovery was complete except for a slight swelling where the fracture had occurred.

"On or about June 10, the altogether domesticated Vera slipped on the kitchen linoleum in the patrolman's residence which she had entered many times previously. The fall resulted in what appeared to be a dislocated shoulder, an injury from which she had not fully recovered at the time of the transfer.

"Lack of control of faculties was noticed in a fawn (Ida) July 21. This condition became quickly more serious and seemed to reach a climax July 23 on which date the fawn was actually unable to get to its feet for a couple of hours. The symptoms were lack of control of motions with accompanying loss of strength in spite of the fact that not a single

meal was missed during the entire ordeal. Four injections of calcium gluconate were given at the rate of one each day beginning July 23. This treatment was followed by use of Fowler's solution of arsenic, given orally from July 22 to August 12 at the rate of 2 drops the first day and increasing the amount 1 drop each day until 10 drops were administered, then reducing dosage one drop each day.

"The fawn showed gradual improvement since July 27 though the effectiveness of either treatment is a matter of conjecture. It is possible that recovery would have taken place regardless of treatments.

"The striking similarity in the symptoms of this fawn's illness and those of cases 1, 3 (Eddie), and 4 (Tim) appear to show that the same cause was responsible.

Weather Conditions

"The weather during the infancy of antelopes, no doubt has a considerable effect upon their health and chances for survival. Where fawns are raised artificially, on an imperfect diet, this is especially true.

"The month of May was wet and cold. Of the 2.97 inches of precipitation, 1.89 fell since May 18; one inch of snow came during this period and there was but a single clear day. There were 4 days of precipitation during early June, aggregating .83 inches by June 9. During this time our fawns were in ill health, and a considerable amount of work had to be done in constructing shelters wherever the fawns were in the habit of bedding down. There is a distinct possibility that the damp and cloudy weather had something to do with the scouring of the fawns.

"Since June 9 the wet weather ceased and there was a rather sudden rise in temperature. In fact, warm, dry, weather prevailed from then on.

Transferring Kids

"On September 6, Clarence Johnson arrived from the Desert Game Range with a Chevrolet pick-up equipped with

a stock rack, to transport the antelope fawns (1 buck, 5 does) to their new home. It was our intention to begin the trip in the evening so as to plan our arrival for the coolest part of the day; but one of the fawns, Blondie, defied our efforts to capture her. Therefore, it was necessary to postpone departure until morning.

"Most of the fawns displayed a great deal of fear immediately after being loaded into the truck bed which had previously been padded with blanket material partitioned through the center, providing two separate compartments. Even after extending the sides of the truck bed, at least one of the animals demonstrated that a 3-month old antelope is able to leap 5 feet from a standing position. A partial rook had to be constructed to discourage hazardous struggling of the fawns to regain freedom.

"After loading the remaining fawn and feeding them all, Johnson and Anderson started on the 870 mile trip at 8 a.m. Infrequent stops were made to inspect the animals. They appeared to be comfortable and lying down as long as the vehicle remained in motion. On the road they were fed 3 times daily as usual, the time varying slightly so as to make it possible for us to obtain hot water for diluting canned milk, and for cleaning bottles and nipples. The feeding of grain on the journey was considered of some importance as it was the only means of supplementing the liquid food. Driving was performed in shifts and all through the night.

"We arrived at the Desert Game Range at 10:30 a.m., September 8, where the fawns were reluctant to leave the now familiar truck bed — one of the many indications of their wonderful adaptability. Once out in the quite adequate inclosure, their characteristic curiosity reasserted itself, as did also a natural hunger, thirst and need of exercise. The Game Range headquarters is situated in an oasis at an elevation of about 3,000 feet. There is an abundant water supply and vegetation ranging from Bermuda grass to shadscale within the inclosure to be occupied by the fawns.

"At the time of this writing we have just received a letter from Frank Groves, refuge manager at the Game Range, dated October 22, 1945, in which Mr. Groves reports that the antelopes are doing fine — wander a half mile or so out on the desert, but towards evening come back to headquarters to be fed.

"Our partial success in rearing 6 out of 10 antelopes compels us to point out by way of comparison that the wild herds have shown only a 2 per cent fawn survival this season as well as last year. The year before that slightly better at 8 per cent survived. For this very reason we have considered our project of special importance and have given to it unlimited time and effort.

"In any attempt to rear antelope fawns in captivity, the availability of a trained veterinary would be the greatest possible asset. In fact, the ideal arrangement would be to have a veterinary supervise the project."

Anderson's report is a glimpse behind the scenes in the life of the pronghorn kid. Obviously, in its earliest days it lives in daily peril. In closing, he mentions the low survival rate of the kid. This is substantiated throughout the West by experiences and incidents during this study. As the days pass the does show decreasing responsibility towards their young; and as the season progresses they seem to relinquish it altogether, although the kids still persistently follow them when they can.

Anderson points to weather as one of the limiting factors in kid survival, to which field workers will heartily agree. The part that disease or other hidden influences may play, must for the time remain unmeasured.

There is a cooperative relationship among antelope does. It is their custom when the kids are a few weeks old to forsake the cares of motherhood and have their little pastimes without the responsibility of watching the family kids. This duty is delegated to one of the group. During an afternoon, a mother antelope left to act as nursemaid may have in her charge as many as 10 to 12 of the young of other mothers

using the same range. The plan seems to work very effectively and may be a method for careworn mothers of the genus *Homo* to follow. There is apparently no definite consultation. The kids will be scattered about at play or sleeping contentedly in the sun, while their mothers drift or even hurry away to carry on some of their extra-curricular activities, follow the whims of imagination into some new pasture or, inclining toward the more cultural side, contemplate a glorious vista from the rim of the valley; or womanlike, just gossip with the neighbors — at least that's the way it appears.

In the meantime the kids may rise, stretch, yawn, drift over to the "mother in charge" and seem as much at home as children at a kindergarten. There is no apparent fright, nervousness, anxiety or timidity. This may last an entire afternoon.

During this period the mother on guard may find it expedient to nurse her own kid, but should a step-child rush in to sip the refreshing liquid, great resentment wells up in the heart of the foster parent, and like the traditional stepmother in *Cinderella*, she metes out harsh punishment.

As time passes the kids become more and more restless; but before too long, their mothers return and there is much excitement as the kids awake with startling alacrity from a restless sleep in which they seem to be dreaming of copious supplies of antelope milk; rush to their mothers to nurse with vigor and haste for a minute or so, then bounce about like animated toys, once again in happy abandon.

Antelope Kids at Play

Antelope kids are among the most fascinating "children of the wild." They are playfully active from the fifth or sixth day of their life until they are about 6 months old. By then they have attained the size of small mature antelope, and seem to gain some of the dignity of maturity, which marks the loss of their childlike ways, a sorry fact common to most animals, including men. Antelope mothers are very indulgent and permit their young to take great liberties with

them. If one watches at a waterhole in concealment, some of the more intimate family life of the antelope can be observed.¹

Coming cautiously one day over a rimrock at Spanish Lake, I saw a group of seven antelope kids with their mothers on the hard shore-edge of the receding lake. The mothers were contentedly resting in the warm June sun, apparently at ease and unaware of my approach. The kids were having a great time in a quite highly organized game. Rushing away across the flat rim of the lake shore, as though started by a lifting of a barrier on a race track, they ran neck and neck, swung in a wide arc and then thundered back, their tiny hoofs beating in unison as they soared rather than ran, their bodies parallel to the earth. Upon nearing the starting point they drew up to a stiff-legged stop at their mothers' sides, gazed with dreamy eyes around the immediate vicinity, then wheeled away on another flight, with apparently enough power and enthusiasm to drive them to the summit of the Rocky Mountains 1,000 miles away.

At break-neck speed the seven raced out, until finally the last animal in the group began to swing gradually toward the right. This seemed to have a pulling effect on the other six. They swung in a wide arc and raced back to the point of beginning. One of the kids in exuberance leaped upon his mother's back as she lay resting and stood there with distended nostrils, sucking in the desert air and beaming contentment. With a toss of his head he leaped off and landed on the back of another doe. Only an occasional twitch of the skin by the adults showed their mild displeasure. Evidently all was well, so two of the others followed suit. Soon there

¹Scientists favor "calf" as a proper designation for young pronghorn. In formal writing, I am content to accept this nicety of discrimination but not when referring to their play. Then they are only "kids." This word connotes boundless energy, spritelike mannerisms and those endearing charms that tempt you to gather them in your arms. Hard of heart is he who sees the week-old pronghorn as a mere "calf"; and obviously he has not known them in the wild.

was a wild round of leaping and bounding, and a game of tag was in full swing with does as bases. The young bounded from back to back with little spurts to eat up the distance between mothers.

How long this wild revel would have continued must remain unknown, since a couple of does came up from behind, crossed the wind, and scenting me, ran rapidly through the draw in full flight. At the interruption, the mothers leaped to their feet and adults and kids dashed away, the kids all quickly taking the lead and dashing off toward the horizon, with the mothers acting as rear guards.

Like the kids of goats they are "sure-footed." A rock escarpment in an otherwise flat plain becomes a center of great activity. As many as a dozen kids may compete for the crest of this outcrop and mountaineers show no greater satisfaction when they attain the summit of The Matterhorn. Unaffected by human inhibitions, they do not hesitate to push a brother off into space and beam as though they had the sadistic senses of a spoiled child when he sprawls on the ground a squirming mass of flailing legs.

One would imagine that, with such long and agile legs, running would be a substantial part of the play pattern; and indeed it is. Mass activity is common if a number of kids are thrown together. I do not speak their language and therefore my interpretation of their acts may be greatly in error; but if I may judge from their intentness, they are as interested in "touchdowns" or "baskets" as the boys on the sand lot next door. And as with our own species, only the youngsters play, the more mature and sedate pronghorns standing gingerly aloof when a game is in progress.

Sex Ratios

Of about 300 kids taken at the Charles Sheldon and Hart Mountain Refuges to be reared for restocking purposes, the sex ratio was approximately 45 males to 55 females (45:55). This proportion has also been observed in adult herds and on other kidding grounds in Oregon.

Arizona reports contained in the January 1941 issue of the *Pittman-Robertson Quarterly* indicated that the sex ratio before a hunting season was declared on long-protected habitat, was 1:0.85. In a later report from the same source a survey of antelope ranges revealed a buck-doe ratio of 1:1 after a long protection period. This ratio is similar to that in Oregon in 1938 before a hunting season had been declared.

Data on sex ratios, accumulated in Oregon since the beginning of this study are given in Table 8.

TABLE 8.
Sex Ratios of Oregon Pronghorns

<i>Year</i>	<i>Ratio of Bucks to Does</i>
1936	1:1.20
1937	1:1.10
1938	1:1.50
1939	1:1.60
1940	1:1.30
1941	1:1.30
1942	1:1.10
1943	1:1.09
1944	1:1.67

In spite of seven successive open seasons (1938-44) the ratio between bucks and does remained nearly balanced. A ratio of only 1 buck to 5 does (1:5) would permit increasing returns. This lack of marked change in the sex ratios, of course, is explained by the fact that does as well as bucks have been shot in Oregon. With the persistent kill of both sexes a proportionate decline in pronghorn herds could be naturally expected. This is occurring and if present practices are continued, a complete closure followed by a slow restoration and rehabilitation program must ensue. That history should repeat itself seems absurd, but an effective management program is handicapped by the indifference of the general public to a program of self education in distinguishing between sexes. The common opinion is that both sexes should be shot, as sex determination is impossible. An effective educational

campaign to enlighten hunters and the public is essential.

It is significant that hunting practices change little, except under strict regulation or long educational periods. In spite of the desirability of shooting bucks only, specific restrictions have been lacking because of common opposition, and hunters have persisted in taking both sexes for 7 years.

Potential Birth Rates

To anticipate birth rates we should know something of the average number of young which doe antelope may bear in any one year. Observations and available records indicate this to vary from year to year between one and two kids. Up to the present there is no way of predicting the average for any specific year. Because does breed for the first time when 14 to 16 months old, and twins are common, people are inclined to be over-optimistic in predicting increases. Unfortunately, they fail to take into account the short life span of the doe (it being doubtful if she bears kids for more than 6 years) or the frequency of single kids, or the high infant mortality rate.

The 5-year increase in the pronghorn antelope herd on the Wichita Mountains Wildlife Refuge, Oklahoma, is clearly shown in a report recently made by Biologist Charles H. Rouse.¹ The present stock of antelopes originated in New Mexico after previous attempts at stocking the Wichita Refuge with antelopes from Nevada had failed. Biologist Rouse tabulates results of this introduction as follows:

<i>Year</i>	<i>Number Introduced</i>	<i>Births</i>	<i>Losses</i>		<i>Number at End of Year¹</i>
			<i>Adults</i>	<i>Fawns</i>	
1938	12	5	5	4	10
1939	---	7	2	2	15
1940	22	7	10	---	32
1941	---	15	1	---	46
1942	---	20	2	---	64

¹Apparently included are resident pronghorns not to be confused with the introduced stock.

¹Biological Surveys, Division of Wildlife Research.

The present herd (1942) appears to be composed of 17 adult bucks, 12 adult does, 15 yearlings, and 20 fawns.

E. R. Sans, former Superintendent of the Charles Sheldon Wildlife Refuge, reported as follows relative to the sex ratios of the 300 kids collected for transplanting: "From my experience I would say that about 60 per cent of the does have twin fawns and about 20 per cent of these are taken the first week by predatory animals. The majority of does over 3 years old have twins."

As the work has been conducted for only a few years, this observation leads to some speculation, since with the complete closure on antelope hunting from 1913 to 1938, there should have been enough mature does for twin kids to predominate each year. In this case, the increase from the small number of antelope left in 1913 should have been more rapid. Whether the cause is pre- or post-natal, the fact remains that data from Oregon ranges indicate a variation in the drop from year to year, as indicated by Table 9.

As mentioned in an earlier paragraph, there is cause for the belief that some does which apparently breed fail to produce young and there is no way of determining what rate of increase will prevail from year to year.

These figures represent the ratios of a selected group and

TABLE 9.
Increase Records by Individual Breeding Does
Antelope Herds of Oregon¹

<i>Year</i>	<i>Singles</i>	<i>Sets of Twins</i>	<i>Increase Ratio of Does to Kids</i>
1936	62	97	1:1.65
1937	118	91	1:1.43
1938	99	128	1:1.56
1939	131	72	1:1.35
1940	111	66	1:1.37

¹Sight records of known family groups are hard to procure and account for the small number recorded. The increase relationship for female antelope with kids indicates a variation from year to year in their get.

not of the does in the entire population, for which the ratios varied from 1:1.08 in 1937 to 1:0.17 in 1944. Thus the yearly variation is a management factor of great importance.

Records of single and twin kids have been obtained from various sources. Perhaps the most explicit information on small groups is from Dr. Ernest Untermann, Director of the Zoological Garden Washington Park, Milwaukee, Wisconsin, as follows:

"Our Milwaukee Zoo had some Pronghorn Antelopes from 1924 to 1930. The first pair came from Alberta, Canada and bred the first year. The breeding season was from October to November, and the fawns were born late in May or early in June. No observations were made to ascertain the exact number of days of gestation. The record says seven months.

"The pair grew into a herd of ten during six years, and each female produced a pair of twins at the end of May or beginning of June. But paratyphoid killed both fawns and adults every year, and at the end of six years the parent pair also died from the same disease."

Dr. W. M. Mann, Director of the National Zoological Park, Washington, D. C., says:

"In reply to your letter in regard to pronghorns at the Zoo, we have had forty in the collection during the history of the Zoo.

"Six of them were born here. None of them were twins, and none did very well.

"We have no accurate data, but the period of gestation is about eight months."

The Milwaukee record shows that this pronghorn of northern species consistently produced twins, regardless of its age, while the other reports indicate birth of single kids only. It has been observed in the southern states that single kids appear to predominate, although no comprehensive

records are available. This raises a question as to whether climatic zones may affect antelope get, or if, perhaps, subspecies differ in reproductive powers. It appears in Oregon however, that from year to year different increase ratios exist, based on the number of offspring of each doe.

In studying the available material on pronghorns from other ranges, there is evidence that field observers find conditions similar to those in Oregon, in which there is no uniformity in the kid crop per year. Evidence of this is found in the following table continued in *Pittman-Robertson Quarterly* for January 1944.

TABLE 10.
Variation in Kid Crop, Colorado

Date	Area	Total Mothers	Total Young	Twins	Percentage of does with				
					3 kids	2 kids	1 kid	0 kids	
7/29-8/1/41	Hugo	118	83	98	29 ¹	0.8	11.0	58.5	29.7
8/11/42	Warren	80	59	73	28	----	17.5	56.3	26.2

¹Includes one set of triplets

There is a reference in the above table to a get of three kids. In our work on this species there have been several similar instances reported. However, knowing the habits of the pronghorn to loan their young to another doe for "the afternoon" and lacking sufficient proof of relationship to the doe, a full acceptance of Oregon triplet records was not justified. Since they are so infrequently included in the sight records, it is obvious that if three kids are dropped, their influence upon population trends would be most insignificant.

Hoyes Lloyd, of the National Parks Bureau, Department of Mines and Resources of Canada, wrote under date of February 3, 1941:

"We have antelope in one national park, namely Nemiskam National Park in Alberta.

"Not much mention has been made by the various wardens of the proportion of twins in the herd, but there is one record, in June 1940, which may be of use to you. At that time 25

kids were known to be in the park, and in this number there were two sets of twins."

Murie (1940), says: "Twinning is not at all unusual. Between June 4 and June 11, six does were seen with twins, and seven with a single fawn. Some of the does with a single fawn may have borne twins." This conforms to experiences in Oregon and exemplifies the need for annual inventories on the kidding grounds to find out what the potential increase ratio might be. It will have a definite effect on the policy of harvest in the succeeding years.

In the October 1944 issue of the *Pittman-Robertson Quarterly*, Arizona gives antelope sight records in a survey of 907 does seen with 223 fawns, the doe-fawn ratio being substantially 4:1. The survey crew commented on this fact as follows: "This unbalanced ratio was largely the result of heavy coyote predation. Local stockmen reported increased coyote activity and, with one exception, all coyotes observed were lurking near bands of antelope."

From similar records, and field observations in Oregon, it can be concluded that there are often wide variances in the annual doe-kid ratio and in some years increases are hardly appreciable.

Life Span

Because of the wide-ranging tendency of the pronghorn, few authenticated records of its life span in natural habitat are available, but there are many indications that it is short. The does breed when very young, from 14 to 16 months being the average age of the first mating. As in sheep, their teeth show senile decay early, and the well-defined color pattern of the younger animals is lost as they mature.

William T. McKean, Big Game Survey Leader, Pittman-Robertson Project 12-R, reporting on 202 antelope taken during a 4-day buck antelope hunt in South Dakota,¹ listed their ages as follows:

¹April 1943 issue of the *Pittman-Robertson Quarterly*.

<i>Age</i>	<i>Number</i>	<i>Per cent</i>
1-2½ years	74	36.7
2½-4½ years	74	36.7
4½-7½ years	52	25.7
7½ and over	2	0.9
	<hr/> 202	<hr/> 100.0

No details were given as to how age was determined, but presumably the teeth and other physical factors were used, at least to segregate the groups. Only a small per cent are in the over-mature group, and more than 73 per cent were not over 4½ years. This is no doubt a representative sample, as hunters rarely select pronghorns by quality or age class.

The use of bands or tags to determine the life span of pronghorns has not been effective in this study. Although a few kids were tagged, no returns have been recorded. This is believed due to several factors — the annual pronghorn kill is limited; tags may be overlooked or ignored by persons uninformed as to their purpose; and the small tags used on kids probably would be well concealed in the ear hair of the adult.

On sagebrush-alfalfa range of the Oregon State Game Commission's Ontario game farm, where natural range conditions appeared to be closely simulated, two pronghorn kids developed normally for 2 years and from then on there was a gradual decline in their vigor and health. Despite excellent care their life span was only 4 years.

Ernest Untermann, Director of the Washington Park Zoo of Milwaukee, Wisconsin, reported similar experience with a herd of 10 pronghorn antelopes which were affected by paratyphoid each year. The parent pair died from this disease at the end of 6 years.

Major Robert E. Treman in writing of Wyoming antelope in *Field and Stream* (June 1, 1937) says: "Antelope reach their maturity at five years, and live to about eight."

Thus, in spite of the lack of complete, precise data based on case histories, there is general agreement that the life span of the pronghorn is short. This is an important managerial fact.



3

Pronghorn Antelope in Relation to Civilization

THERE ARE 61,000,000 ACRES IN OREGON, APPROXIMATELY two-fifths of which was pronghorn habitat in the days of the first explorers. Today antelope are found in the southern half of their former range in fair abundance, but elsewhere only an occasional wanderer or small band is found. For over 70 years, no antelope have been reported in the Klamath or Rogue River valleys.

Habitat Preferred By Antelope

There is enough evidence to indicate the preference of pronghorns for rolling plains. Historical accounts of the days when these animals were first seen picture them at home on the grasslands and sage flats of the plains country or plateaus. Thus do they live today in Oregon. Here civilization has not driven them to such wooded sanctuaries as they inhabit in New Mexico, Arizona, or Texas, except in a few small areas, like the Pumice Flats east of Bend, where human pressure forced them from the open range into the juniper forests. Here their chance of survival is decreased by farming on lands bordering these forests, and the increased amount of cover for such predators as bobcats and coyotes. Here, too, the effects of winter are more critical. In the period from 1936 to 1939, when herds on the open plains were increasing noticeably, this herd did not increase.

From this, and other examples, it is obviously advisable to hold the pronghorns to ranges for which they have shown a marked preference since early days. With the shifting of antelope of the Southwestern States to wooded cover, their survival has been jeopardized. Theodore Knipe (June 1944), comments on the fact that the pronghorns have been forced through acts of man and range use to occupy about as much woodland and timber types (i.e., juniper, pinyon, grasses and weeds) as they do grassland (snakeweed-pinkue associations in that range). Concerning survival problems, he says: "The preservation of the antelope is synonymous with the restoration of grassland, which constitutes one of our greatest and most important conservation problems."

Oregon has a wide distribution of sage, the predominant browse food of the pronghorns, together with range weeds and grasses which are known to be palatable to the species. Vast stretches of isolated rolling desert and tableland comprise the southeast portion of the state. Most of the territory lies within Taylor Grazing Act districts, and private ownership with its restrictive fences is not the problem that it is in some states. Texas and other Southwestern States have large fenced tracts; and though fencing does not keep out antelope the policy of the landholder can be beneficial or detrimental to antelope. Federally owned lands are far in excess of private holdings. The practice has been to allow seasonal grazing with herders and riders on these leased lands, restricting the domestic animals to definite units of ground. Fences have been deemed impractical up to this time.

In this native habitat, the pronghorns of Oregon live for the most part undisturbed. The woodcutter of the Southwest is not a problem on this range. The fringes of only two or three of Oregon's cities intrude into it. Paved roads exist only on the margin of this habitat and the rugged roadways that traverse the pronghorns' home have so disheartened local residents, that people have often spent years of their lives without seeing the herds browsing only a few miles away. Though this will change, good herd distribution can

protect the animals to a considerable degree for years to come. The fact that there is little need for high-speed highways in such parts of the state will assure protection of pronghorns from this menace until conditions change.

The pronghorn habitat areas of southeastern Oregon are at elevations of between four and seven thousand feet. Seasonally, the animals may spread to the crests of the less precipitous mountains, rising as high as 8,500 feet. Most of the region is an arid plateau, comparable to much of the range in southwestern United States which is now barren of big game, but which appears capable of carrying pronghorns in some abundance.

The elevations of the frequently used pronghorn habitats in Oregon are as follows:¹

<i>Area</i>	<i>Elevation in Feet</i>
Fort Rock	4,300
Christmas Valley	4,900
Silver Lake	4,350
Chewaucan Basin	4,340
Drake's Flat	5,500
Mule Lake	5,000
Big Juniper	5,850
Hampton	4,416
Hart Mountain	8,100
Flook Ranch	5,200
Catlow Valley	3,900
Anderson Valley	5,250
Tudor Ranch	4,100
Crowley Flats	4,075
White Horse Ranch	4,380
Antelope Creek	4,400
Owyhee Desert	4,000

¹These figures are based on elevations where pronghorns are commonly found. They do not include extreme heights. For example, on some ranges pronghorns may climb to an elevation of 8,000 feet seasonally. It is not their common range, however.

TABLE 11.

Acreage of Private and Federally Owned Lands in Malheur, Harney, and Lake Counties

<i>County</i>	<i>Total Acres Millions</i>	<i>Federal Land Millions of Acres</i>
Malheur	6.3	4.9
Harney	6.4	4.7
Lake	5.1	3.4
Total	17.8 Millions	13.0 Millions

In other sections of the North American Continent pronghorn are found at the following elevations:

<i>Area</i>	<i>Elevation in Feet</i>
<i>United States</i>	
California	4,500
Nevada	3,800
Arizona	5,500
Utah	5,000
New Mexico	4,900
Texas	3,600
Colorado	5,000
Wyoming	6,000
South Dakota	3,600
North Dakota	3,000
<i>Canada</i>	
Alberta	2,100
Saskatchewan	2,500
<i>Mexico</i>	
Sonora	4,000
Baja California	3,000
Chihauhau	5,000

In the Canadian habitat at about latitude 50 degrees, elevations inhabited by pronghorns are comparatively low. Animals from these ranges have dark pelage and the other markings are clear-cut. In the southern ranges of approximately 30 degrees latitude, as in Texas and Mexico, the color pattern is softer, and contrasts are not so sharp. Intensity of sunlight in the higher elevations probably affects their coloring. In the arid regions the continued brilliant sunlight may also affect the coloration.

Antelope drink water the year round if it is available.

During a snowstorm on December 21, 1938, Meyer watched a band of 861 antelope come to a waterhole, take a few sips and move on. Water is especially important during kidding time and in summer, so that when pronghorns are abundant, a well-distributed water supply assures good distribution.

If water can be made available in areas outside of privately enclosed meadows and fields, all game forms will be benefited. The mule deer, originally inhabiting the desert ranges in Oregon, has now been forced by man back to the scattered pine stands of the Ochocos, the Wallawas, and the higher parts of the desert range. Mule deer on the slopes of the Steens Mountains live under conditions similar to their original desert range, but this is the only place where this species may be found in habitat comparable to that occupied before the coming of the white men.

Adequate desert water sources, combined with protection, may restore mule deer to ranges long ago forsaken. Sage grouse, which are becoming abundant in some areas in Oregon, will also be benefited by water restoration, if properly managed. Waterhole improvements will also provide meadows, equally essential for the sage grouse. Thus the entire program of antelope management and range improvement will aid in sustaining wildlife abundance and benefit domestic stock. In an aerial survey of Oregon ranges in 1944, it was obvious that vast stretches of land could apparently be made much more productive by the improvement of potential water sources.

Discretion, good judgment and thoughtful consideration must be the foundations upon which this work is based. It is not practical to attempt to return the great arid plateaus of pronghorn country to wildlife alone. The program must be compatible with management of domestic livestock, but ultimately improvement for all forms can be attained. Such work may set an example for improving other western ranges to restore them to optimum production of both wild and domestic animals.

Conflict Between Antelope and Domestic Herds

Particular attention has been paid to ascertaining the direct conflict which may exist between antelope and domestic animals. Since the duration of the study, the most serious conflict has been in the use of water, or on enclosed pasture, hay, or grain fields. Antelope have not been accused of using the range to a point where domestic animals are placed at a disadvantage, but there have been complaints, general in nature, on a few favored areas, or when they occupy a range from which sheep have been removed.

Aside from this, both cattle and sheep men of the desert country have been fair in their views, and the present antelope abundance in Oregon is due in large extent to their interest. Antelope herds have increased by their efforts to promote respect for game regulations. Enforcement subsequent to 1913, when full protection was given to antelope, was not adequate to hold down violations. The intervention of stockmen saved many pronghorns, the parent stock of the present herds.

Through demands by stockmen for predatory control a great handicap to the increase of antelope has been removed. Several thousands coyotes have been removed from Hart Mountain and adjacent range in the heart of the antelope country, during the past 20 years. This has been reflected in herd increases greater than in other areas where predatory control was less effective. Decreases in antelope population were noticed in the area in 1943 when predatory control operations were curtailed owing to the wartime man-power shortage.

It seems impractical to attempt a classification of each species of plant food to establish its importance to antelope, sheep, and cattle, except in a general way. It does seem advisable, however, to analyze the relationship of these animals to each other on the range and to determine the effect of each on range foods.



Figure 34. Hart Mountain, elevation 8,100 feet. Pronghorns range from the rolling plateaus to the crests of the desert mountains. Photograph by George B. Cox.



Figure 35. Windswept plateau east of Abert Rim near Crook's Peak, where pronghorns feed even in midwinter. Photograph by author.



Figure 36. Barrier to antelope drift south of Harper, Malheur County, June 10, 1941. Photograph by author.



Figure 37. Looking into DeGarmo Canyon, Hart Mountain, Oregon.
Photograph by S. G. Jewett, U. S. Fish and Wildlife Service.



Figure 38. Antelope, South Dakota. Photograph by F. M. Dille, U. S.
Fish and Wildlife Service.



Figure 39. Antelope, Gardiner, Montana, 1916. U. S. Fish and Wildlife Service Photograph.



Figure 40. Group of antelope in Arizona. Photograph by E. A. Goldman, U. S. Fish and Wildlife Service.



Figure 41. Pumice flats in Oregon, favored antelope range, yet sparsely vegetated.



Figure 42. A close-up of the vegetative stands in occupied pronghorn range. Photographs by author.

It is apparent that, although larger than sheep, the antelope is restrained by its foraging habits from taking as much food, except in early spring when grasses are first available. At that time, tempted by the tender shoots, an antelope will consume in a day probably one-third more of the range forage palatable to both species than a single sheep would take under the same conditions. Sheep usually bed down at night, while pronghorns continue to browse. Stomach analyses of both animals showed a sheep stomach to contain about 4 gallons or 20 pounds of bulk food, while that of the antelope holds about half as much. Stomachs collected near Guano Reservoir in September 1945 contained food averaging 8 pounds for six specimens.

During summer, fall, and winter, antelope food is of wide variety, including most of the range weeds and browse plants, with the latter predominating. Sheep may consume many weeds, but their taste is more restricted. For example, rabbit-brush (*Chrysothamnus nauseosus*) or hoary arnica (*Arnica foliosa*), taken avidly by antelope are of limited value for sheep or cattle forage.

The pressure of Oregon antelope on the range becomes less noticeable as summer progresses. They eat considerably less of the desert grasses and appear to leave the range in much better condition than sheep and cattle. With the exception of the early spring grasses, there are few reports of antelope eating desert vegetative stands to excess, as sheep often do if improperly herded, or if left to forage naturally.

Antelope will daily cover an area approximately 3 miles square. They do not usually feed in droves as sheep do, except on favored spots like dry lake beds where some particularly palatable plant is found for short periods of time, for instance, the sourdock (*Rumex paucifolius*) found in summer on the lake beds of central Oregon. Most of the lakes in the arid sections of Oregon are broad and shallow, and evaporate quickly in the hot summer. Weeds grow luxuriantly for short periods on these drying beds, and antelope

come from long distances to feed there. This tendency to forage over a wide area and to abstain from water for long periods, with only an occasional trip back to a waterhole from a remote point, protects the adjacent range, as they do not consume vegetative stands to the point of depletion near these sources. Cattle, on the other hand, will forage near water and may damage great productive areas. This destruction of ground cover hastens evaporation and may lower the water table by several feet, causing erosion. No record of antelope causing similar damage either to Oregon range or elsewhere was found during the period of the study, and in numerous conversations with both cattle and sheep men in antelope country, these animals were reported to be of little damage to forage.

When antelope concentrate in large herds on their wintering grounds, the effect upon desert vegetation is readily noticeable. Conflict with domestic grazing practices has thus resulted in some sections of Oregon. The Drake's Flat herd, when at its highest level of abundance, did affect grazing for sheep or stock during the ensuing season. The animals crop the grasses so closely that vigorous stands cannot be expected if grazing is allowed on the range in early spring following winter occupancy by pronghorns.

In public land management, it is wise to consider these areas. They are few in number and can be best managed either by allowing them to remain ungrazed during the seasons when antelope are not using them heavily, or by deferring grazing by domestic animals until these grass stands have recovered and seed crops are assured.

To run sheep on a range in April or May following severe winter usage by antelope amounts to year-around cropping, and is poor management. Lessees of public lands are open in their criticism of such dual range usage. As these areas are comparatively small, they will have little effect upon the animal grazing months in Oregon, but can be a source of trouble in cases where the species is unappreciated.

Until the past few years, Oregon public grazing lands were not administered locally in management units. With grazing officials now stationed throughout the areas involved, it is to be expected that plans for multiple use will be projected over a long-range period to take into consideration the welfare of both domestic stock and wildlife. These may need adjustment from season to season, depending on range conditions.

A frequent conflict between antelope and sheep occurs at kidding time if bands of sheep move into areas occupied by antelope does and their kids. A doe with newly-born young will nervously pace the fringes of the sheep flock to protect her 1- or 2-day-old kids, which may lie quietly for a while as the feeding sheep pass within nose-touching distance, and then rise on trembling legs to following the moving mass. The mother becomes frantic and the herder exasperated as the kid stumblingly attempts to keep up with what seems to be its only tie to security. The herder, who does not want a bummer antelope in his flock, rushes over to rescue the kid from the band, the dogs lend their noisy help and all is bedlam and confusion. By now the mother antelope is in terror and her actions frighten the other pronghorns within close range. These react with much running and blowing, until all are worked into a state of frenzy, and just about the time the herder separates the kid from his flock, the pronghorns will dash away and disappear over the horizon. This accounts for the large number of antelope kids in captivity, as they are often taken to shelter after being separated from the sheep but abandoned by their mothers.

Cattle-Antelope Relationship

Antelope do not hesitate to join herds of cattle on the range, and the cattle seem to pay no attention to them. This was even observed by the early Spanish explorers on the antelope ranges of the Southwest. In the records of Coronado's visit to New Mexico he mentions seeing "deer with herds of buffalo." He was undoubtedly alluding to antelope, from

his description of habitat and locality. Such associations with other animals are common, the exception being aversion of does to flocks of sheep at kidding time.

Antelope Damage to Farm Crops

In most instances the complaints of farmers that antelope destroy range forage are lacking in specific detail. Often they are based on conclusions drawn from observing them on grazing ground with the assumption that antelope are consuming food needed for sheep or cattle. In fact, however, the antelope has a varied taste in food and a special preference for weeds so that there usually is little conflict on open range. Stomach analyses show a preponderance of sage (*Artemisia*). There are some cases where damage to farm crops has been serious. In 1937, damage to wild hay was reported by a farmer in Malheur County. Investigation showed that the animals were concentrating in the meadow and trampling the hay as they moved to and from water. The only available water supply in the vicinity was in the center of this meadow. In such cases, most game departments are empowered to make an agreement with the farmer to provide water for the antelope. When there is only one water supply on the range, excluding antelope by fencing is rarely satisfactory, as they will make every effort to obtain water and will damage both fences and crops.

A similar situation was reported from the Tudor ranch on Crooked Creek in Malheur County in the late 30's. The animals made deep trails across alfalfa fields en route to water. The area was enclosed by a 3-wire fence, but the lower wire had been torn loose in at least six places. This was undoubtedly the work of antelope, with their characteristic of crawling under fences rather than jumping over them.

Any effort to protect both wildlife and domestic animals should be on a more or less permanent basis. Temporary measures are ineffective. For example, in many instances a pipe line a thousand feet long might serve as an expedient to

carry water where both cattle and wildlife could obtain it without menacing the fenced-in crops. But a persistent problem of upkeep is involved. One failure of the water flow might be as critical as if no installation had been made. Innumerable accidents to the line may occur, including damage by freezing weather. On the other hand, a survey of water resources in the area could be made and a spring developed or masonry or earthen dam erected which would be of benefit to the wildlife without endangering agriculture. The United States Grazing Service has done most effective work of this nature on western ranges. The Soil Conservation Service has also developed water supplies needed both by game and domestic animals.

Wherever possible, pronghorns should be drawn away from farm meadows to prevent damage to them and also to avoid their exposure to domestic animal diseases and parasites, which are more often found where domestic animals concentrate than on outranges. At the present time, judging from autopsies, pronghorns of Oregon have appeared to be singularly free of parasites or disease, in contrast to those of other parts of North American range.

Antelope and Farm Fences

One of the problems of southeastern Oregon cattlemen is to maintain many miles of fences designed to exclude cattle from hay meadows where winter food for stock is being grown. These fields are tempting to many animals, and continual vigilance is necessary to keep fences repaired, as a slight break will allow the animals to enter and cause damage.

Antelope crawl through fences rather than jump over them. During our field work on this species no instance was noted where antelope attempted to jump even a low fence. Usually they pass through by quickly wriggling under or between the wires near the ground. Often the excavations of a rabbit or coyote under the bottom wire will permit an

antelope to squeeze through either netting or barbed wire fences. It has been observed from time to time that antelope traveling as fast as 40 miles an hour will not hesitate when approaching a 4-strand fence, but will strike it in full stride and pass through, leaving a cloud of hair floating in the wind behind them. Near meadow fences where water is scarce and antelope numerous, the ground will be strewn with their hair.

Wires must be kept extremely taut to stop an antelope. A 4-wire fence about 40 inches high, with an equal space between the wires, and posts set about 6 feet apart, is much better than a 6-wire fence with the posts a rod apart. The longer distance between posts will allow the wires to spread apart and permit the antelope to slip through.

A desert fence which has proved effective in turning antelope is shown in Figure 55. This picture was taken on the Calderwood ranch near Guano Creek, south of Hart Mountain in Lake County. It was found effective so long as the wires were kept taut between posts.

It will be noticed that the pasture grasses outside of the fence have been used heavily by both domestic animals and antelope. Obviously, such a fence will be tested often when enclosing food and water in a parched land.

Damage to pasture or field fences is not common in southeastern Oregon, except where both waterholes or springs and green forages are enclosed. Here continual vigilance is necessary to keep antelope out of these fields. A slight sag in the wires will permit them to get their heads through, and then it is only a matter of squirming until the entire body has negotiated the opening.

Netting fences would be practical under certain conditions, but in that country, where large meadows are enclosed, the cost is excessively high and they would be useless unless patrolled daily. Coyotes often dig under to hunt mice in the fenced meadows. On the Squaw Butte Range Experiment Station in Oregon where coyote-proof netting fences have

been built, antelope invariably find an occasional coyote hole when they seek entrance for water during the dry months.

Every small hole or depression is a potential entering point for antelope. Therefore, the problem is exasperating and the only effective solution is a good fence, well patrolled and a water supply provided outside of the fenced area, so that the animals can satisfy their thirst without crossing the field to do so. Managers should be cautioned, however, that no records have been found of pronghorns drinking from metal tanks or troughs in the hot, dry areas of the Southwest. The Federal Aid to States program, the Grazing Service, and individual efforts have helped greatly in many instances to supply sources of drinking water in suitable locations.

There are comparatively few accidents in which antelope are injured on fences. Broken legs are rare. In spite of their high speed, keen eyesight permits them to choose places of easy ingress as they approach the barrier; and their progress is rarely checked. Occasionally an accident is reported in which the animal's neck is broken when running at full speed, but this is usually either when the animal is frightened or pursued. These accidents are exceedingly rare for the number and method of daily field entries by pronghorns.

One day while I was watching an antelope doe, she took fright for no apparent reason and ran wildly down Anderson Valley, in the Steens Mountains, crossed a long slope and sped toward a mountain meadow. She passed through a 4-wire fence enroute without slackening her pace of about 20 miles per hour or without stooping, and continued on through the valley and up on the south side. Here she began to feed quietly as though her original intent was quickly to reach this remote spot. She could have easily avoided the fence crossing, but felt no fear of it. It was only a slight obstacle in her path and was treated accordingly.

An antelope ordinarily weighs about 100 pounds, and when its body is thrown against a taut wire at the usual running speed, the wire is often broken. This is a common occurrence on ranges where antelope are numerous.



4

Management of the Antelope Resource

UNCEASING VIGILANCE IS NECESSARY TO OBTAIN ACCURATE data on antelope herds. Because of their extensive range the best period is during the late summer months, probably in August and September, especially during periods of prolonged dry weather when only a few waterholes are still usable. At this time most of the range can be traversed with highwheeled automobiles.

It is said that in portions of the southwestern United States pronghorns abstain from water for long periods, and therefore, do not gather into large herds near waterholes. In Oregon, water is available during the driest summers and although creeks, pools, or seeps are often far apart, the herds concentrate at these supplies and only an occasional antelope, usually a buck, is found on dry range away from these concentrations.

Taking Census

In August and September the immature antelope are running with the adults and are not as likely to lie hidden in the desert cover, so that a very accurate count can be made. Segregation of kids of the year and adults may be difficult for persons unfamiliar with antelope. Although born in mid-May or early June, by September they closely resemble adults. The kids weigh much less than adults and have a

racy appearance that is immediately apparent to the trained observer.

If it is possible to choose, the best time for a ground census is during the hottest days of the year. The herds do not move so actively then, and there is less confusion when approaching, since they will stay fixed for longer periods. With the arrival of cold, sharp days, antelope are continually moving. A herd in one area in the morning may pass around some rimrock and through a valley, and be in a position to be counted a second time. Also, the approach of a car or horse on a cool day will tempt the pronghorns to race, thus adding to the possibilities of error.

If the late summer dates are not practical, it is better to conduct a census in March or April, rather than the late fall months, as sex classification is then more accurate. Antelope drop their horns in the early fall, leaving the bony core, which reduces horn size and thus makes accurate segregation of sexes difficult. At this time a buck may be mistaken for a doe.

Intimate knowledge of all terrain, approximate range of the herds, and their usual runways are among the essentials for making an accurate inventory over a wide area. There is no substitute for a direct count, and since antelope habitat is the most open range in America, the highly technical inventory methods necessary for some game species are not required. On areas where no animals are found, range usage may be determined by means other than counting. Pits which have been dug by antelope to deposit body waste indicate that the area may be occupied, as both buck and doe antelope follow the practice of digging the waste pits with their front feet. These pits will become obliterated in 1 to 6 months, depending upon weather, and are, therefore, better indications than the presence of scats, which dry out and may be visible for a year or more. They are roughly elliptical in shape, about 14 inches long and 10 inches wide. Freshness can be determined by the striations made by the

feet, dampness of the soil or condition of the droppings.

An inventory to determine increase ratios by counting does and their kids must be very carefully conducted. These counts should be made on leisurely trips through the range by car or horseback, so that ample time may be taken to determine doe-kid relationships accurately. Although many sight records of kids may be made in a season, there is a chance of gross error in such observations unless careful scrutiny is given to each case. Only when a doe obviously claims or nurses the young, or where the animals are isolated on such open terrain that no mistake could be made, should they be recorded. This is necessary since does, immature antelope, and kids may all gather together, giving no opportunity to ascertain the relationship.

It is entirely practical to use small, low-speed airplanes on most habitat areas to determine the number of antelope, their distribution, seasonal drift, water utilization and other management facts. Very little antelope range in Oregon is timbered habitat, and therefore airplane surveys are comprehensive enough. The small, two-place Army training planes of high-wing construction with 3 or 4 cylinder air-cooled motors are especially useful for this work. They fly slowly, and at speeds of 70 to 90 miles an hour, permit scanning great stretches of range. High speeds are impractical. At 120 miles an hour, for instance, ground patterns result in optical illusions at elevations up to 1,000 feet, which prevents accuracy. The high-wing construction permits good ground visibility on both sides of the plane. By systematically scanning the ground ahead at a distance of about half to three-quarters of a mile, there need be no blind spots in the flight course. Flights should be made at an elevation of 500 to 800 feet. The low powered motors permit low cost operation, and flights within a 100-mile radius of the base are easily possible. Trips should be made with the first rays of daylight and continued only until mid-forenoon, during which time the oblique rays of the sun on the white

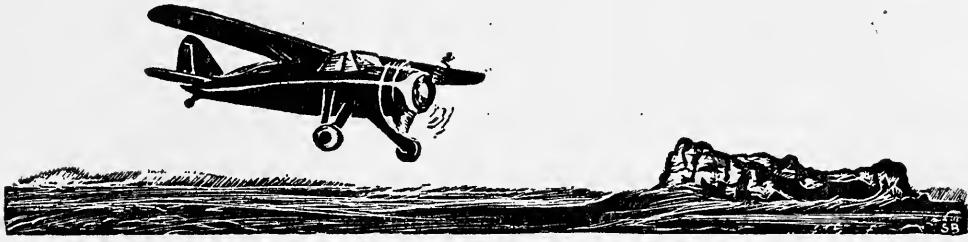


Figure 43. Aerial survey plane used for antelope census in Oregon. Flights are usually made at 500 feet elevation. Close inspection is possible at 100 feet in stable air.

underbody make antelope easily visible at a distance of 3 to 4 miles by means of a good 7-power 40 mm. binocular.

A trained observer can readily spot antelope with the naked eye under these conditions as far as a mile and a half away. Flights should only be made on days when the atmosphere is still; and naturally the early morning hours are best. Care should be taken that the motor turns at a low vibration point. Even a few revolutions' change, either increase or decrease, may cause the plane to vibrate excessively and thereby decrease the efficiency of binocular use. When air pockets and rapidly moving currents develop as the day advances and the earth warms, both vibration and instability result and the work should be discontinued. Surveys can be conducted effectively almost at any time of the year, but should be taken twice a year, in the late summer and in mid-winter, if possible. The late summer surveys will determine the populations at the beginning of the hunting season, showing the distribution and utilization of range and water supplies. Winter surveys when the snow is on the ground will give information on another critical period of the year. These will also indicate distribution, seasonal migratory trends, the effect of weather, accident and predation. Furthermore winter may be the best period of the year to determine aggregate numbers since the animals are very easy to see when silhouetted against the snow and winter vegetation.

In most instances an individual count can be made. Counting should be done by one observer, but he can be aided ma-

terially by means of intercommunicating head phones so that the pilot can be directed or can offer suggestions which will give better ground coverage. The pilot should be game-minded and well trained in observation work. Great concentrations of antelope such as may be found near water-holes or on vegetated lake beds from which water has receded may be too large for individual enumerations. Estimates can be made of such groups and with a little practice they should be accurate within a 10 per cent error. These can be further supplemented by aerial photographs from which estimates can be checked.

Survey planes should have small doughnut wheels. The small low-pressure wheels make it possible to take off or land on very rough ground. For winter use skis are a great aid, as landing can be made on snow on many open spots. A cabin type is almost essential, especially for winter work, and adds greatly to the comfort of the observer even in mid-summer. The seats of the plane should allow good visibility. At least one movable window in the body of the plane or in the door through which photographic shots can be taken is also desirable.

As far as practicable, flights directly into the sun should be avoided. The most effective course for good observation is, naturally, directly away from the sun; but in flying definite patterns, occasional into-the-sun flights may be necessary. Besides, by taking advantage of the terrain, cloud conditions, and other natural aids, into-the-sun flying can be quite effective at times.

Aerial surveys to determine kid crops are not recommended, as size is difficult to determine from the air, especially from August on, when the difference between the youngest and the older age classes becomes slight. In several instances during the aerial census of 1944, a coyote standing still at some distance looked like an antelope from certain levels and angles, and appeared much the same color. It was only by close approach and a change of angle when

his relationship to the ground could be determined, that this confusion brought about by the observer's elevated position, was corrected. Aerial enumerations of kids are advisable only when trained observers, familiar with pronghorns and planes alike, are available.

Introducing Antelope to New Range

Several methods have been used to restock range long barren of antelope. One is to allow a gradual dispersal from occupied range to new areas. Another is to capture kids, rear them to maturity and transplant them to form a nuclear breeding stock. A third method is to capture adult and immature pronghorns and liberate them on the range where stocking is desired.

The first method has had considerable success in Oregon over long periods of time. With prohibition of hunting in 1913, antelope herds were at a very low ebb, perhaps less than 2,000 remaining in the state at that time. The long period of protection from 1913-1938 resulted in their gradual dispersal over ranges (though not all of the ranges) long unoccupied by antelope. There is a tendency to measure such a program by the normal life span of human beings. By this standard, 25 years is a long time. By the standards of nature, however, it is but a moment. In primitive country this dispersal plan is satisfactory, but it is inadequate for Oregon or other western pronghorn habitat, since the use of the range may completely change in that time. To achieve either complete dispersal or widespread occupancy management of antelope must be more direct.

For the past 20 years, attempts have been made to take antelope kids on the desert range at birth or within 1 to 4 days thereafter, rear them artificially and later liberate them on ranges which are to be restocked. In theory, the practice seems good; but an analysis of its results shows it expensive and quite impractical in most cases. It is common knowl-

edge that antelope kids, taken when a day old, soon become domesticated. They learn to rely almost entirely upon human beings and have no timidity. In fact, they become too friendly and affectionate. The result is that most antelope kids so reared are not as adaptable to range conditions as naturally-reared stock, because they have not led a normal antelope life. They use every means and effort to place themselves under the protective care of human beings.

The lack of self-sufficiency is often encouraged by the caretakers, since they feel that the most tractable the animals are, the less trouble they will give, and between these two tendencies, artificially-reared antelope kids do not offer the possibilities for restocking that they would if managed under more natural conditions.

A similar case in point is the practice, generally followed, of raising Chinese pheasants or wild turkeys for stocking. In many districts these birds are kept almost as farm birds, with a result that when liberated they return to farmyards or range close to settlements, where they fall victims of human activities or accidents.

During the past 5 years, about 300 antelope kids have been taken from the Charles Sheldon and Hart Mountain Refuges for restocking purposes. Long before this, other kids had been taken for the same purpose from other areas. So far these manipulations have not established a satisfactory antelope herd anywhere in the Pacific Northwest. On the Squaw Creek area in the State of Washington, small antelope liberations were maintained under heroic efforts, but already this nuclear herd seems in danger of disappearing. To be sure, the experiment is still in its early stages and it may take many years to produce sufficient numbers for hunting or stocking other areas. Time must elapse to justify the procedure. Nevertheless, so far the survival and reproduction of antelope treated in this way has not been good enough to encourage a widespread acceptance of this system. Furthermore, the costs are excessively high. By the third method of

restocking, antelope of *all* ages are captured by corraling, although liberations in some of the Southwestern States have been too recent to prove their full value, new herds have been quickly established. Elliott S. Barker, State Game Warden of New Mexico, wrote on February 6, 1941, as follows:

“As to our antelope trapping, we started this in 1937 and have carried the work on each year since then and to date we have trapped and released alive more than 1,000 head of antelope and have started no less than fifty new herds. There is not much loss in capturing and transplanting the antelope—perhaps not over three or four per cent—but there is a little additional loss always after the antelope are released. In a few instances our losses are rather heavy, due to coyotes killing them before they had become familiar with and accustomed to their new range. Nevertheless, the total loss has not been excessive and nearly all of the plantings made have been successful. For instance, a few days ago we inspected an area where we planted the first 13 antelope that were caught in 1937. Our methods were rather crude then and the antelope were not in very good condition when released. However, we found a total of 22 head on this unit where none had existed before the planting was made and the unit was apparently normal in every respect, there being 8 bucks, 9 does and 5 fawns. Our other plantings have been equally successful.”

Although Texas has been restocking ranges for only a few years, recent correspondence with biologists shows the practice of trapping and transplanting adult and young stock to be generally effective. Henry C. Hahn, Jr., writes, “I know that most of the plants made in the Trans-pecos region have been successful but I cannot give you any figures as to actual increase in population.”

This system appears to be one of the most effective for quick results—undoubtedly one of the primary requirements for present day management because of the rapid change in land usage.

By using range-reared wild stock, it is obvious that many of the handicaps of artificial rearing will be overcome. Antelope taken by this method for release on remote ranges, far from the point of capture, should produce the best results. Obviously, liberations cannot be made on adjacent areas where in a short time the animals could return to their former range.

Perhaps one of the best means of improving management of big herds is by paying closer attention to methods of procuring nuclear stock. Under present practices most of these ventures are expensive. In most instances, this need not be so if the work program is farsighted, and if preparations are made well in advance of the time selected for making captures. Trapping deer without giving due attention to concentrations, or to weather conditions has proved to be extremely wasteful, and may bring the cost per head to a prohibitive level. On the other hand it has been shown that deer taken at a strategic moment when food supplies, weather conditions and transportation facilities are favorable, may reduce the herd cost to such a low figure that any artificial rearing plan would be impractical by comparison. The same principle applies to pronghorn trapping.

Antelope traps are being used both in New Mexico and Texas with good effect and at low cost. As equipment and technique are improved by experience, a reduction in the operation cost per antelope has been very marked. The original cost averaged from \$10 to \$20 per head, but more recently Texas reported 510 head taken for less than \$3 each, or low enough to make trapping practical.

The cost per head under the Pittman-Robertson program now in effect in some Western States averages about \$10. The State of Washington has provided itself with traps and transplanted mule deer at a cost of less than \$5 a head. Obviously, attention to details and timing will increase efficiency to a high degree and result in procuring animals of a mixed age class for stocking at reasonable cost.

The first plan was to use corrals to impound animals under pressure from mounted horsemen, similar to the old cattle round-ups. Antelope can be herded if they are handled carefully, but if crowded they will break and run, or fall exhausted. Corrals located under rims, concealed at the mouth of gulleys, or where they are not seen by the animals until they are practically within the wings leading to the corral proper, have been reported most effective by officials of both Texas and New Mexico.

Trapping equipment consist of two wings from one-eighth to one-quarter mile long, extending in the direction from which the herd will approach. These wings should not be driven in a straight line and should be from 75 to 100 yards wide at their opening. There should be a curvature in this barrier which gradually narrows down to a corral about 100 feet long and 60 feet wide. The entrance to the corral should be arranged so that it can be closed with two swinging gates which are tripped from a considerable distance by a trip rope. The operators of the rope should be concealed, as well as possible and at least 500 feet away unless they are perfectly concealed. The walls of the corral should be curved, narrowing down at the far end away from the wings, and attached to a catching corral 8 by 12 feet. This should have a gate in its wall so that it can be closed. By a little preparation the posts used for the corral can be quickly set and the web strung quickly.

The entire equipment for trapping is inexpensive and of light weight. The wings, corral and trap should be made of 21- to 30-thread cotton fish netting of not greater than 5-inch mesh, and should be at least 6 feet but not more than 8 feet high. The corral and catching pocket should be made of heavy 3-inch cotton webbing. Used netting can usually be obtained free at outfitting yards where fishing gear is seasonally overhauled.

Antelope on the range can be herded by several means. Mounted men on horseback are quite effective, although re-

cently it has been found that antelope can be driven at will with airplanes less expensively and more comprehensively. Whatever method is used, the animals must not be crowded so rapidly as to cause them to break and run; and if they feel they are outdistancing the pursuer without being hard-pressed they work more rapidly toward the trap than if they are crowded. The pilot rarely flies less than 100 feet from the ground. By constantly making figure 8's behind the herd he can hold them from bolting to the rear and can work back and forth at some little distance from the animals, thus insuring their movement toward the pens. There should be no human activity near the corral of traps until the animals have passed within the wings. Watchers may hide themselves on rimrocks at a distance of a quarter of a mile.

As soon as the herds enter the trap, six to eight operators can work down in the mouth of the wings and slowly crowd the animals toward the corral. This may take from 20 minutes to one hour. If this process is unhurried, the antelope become accustomed to the enclosure quickly, but if they be crowded they become restless and uncontrollable. Animals should be left in the corral for at least an hour or two before attempting to move any into the catching pen. The best method for this step requires one man for each antelope. The animal is caught and bound with short ropes similar to those used for holding cattle, and each one is carried out to the transplanting truck and placed in a covered cage with tie ropes removed. Darkness in the truck body quiets the animals and reduces injuries or losses. The animals should be crowded well together so that they can stand up in transit.

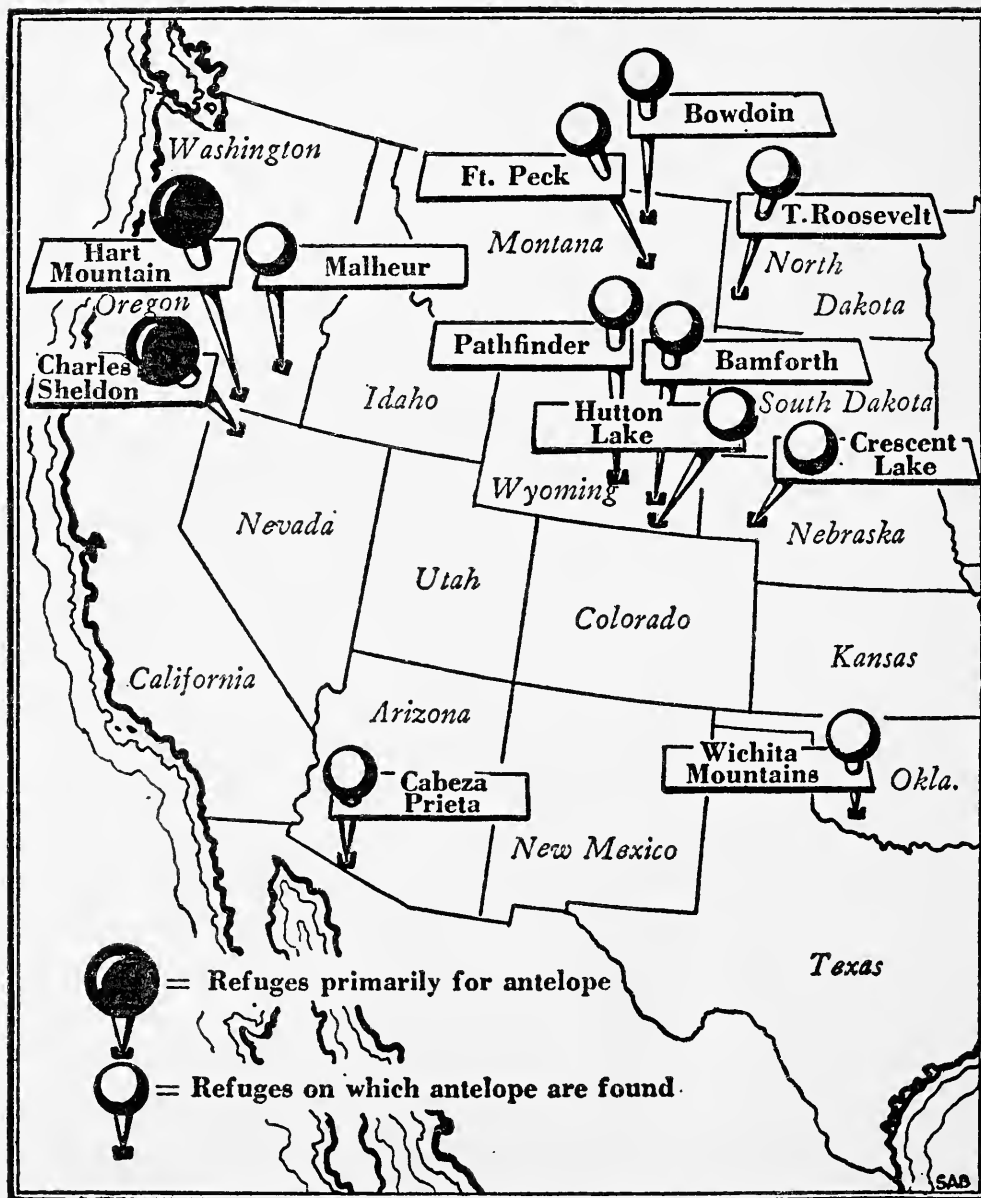
Refuges

Refuges are invaluable in maintaining many wildlife species. Dr. Ira N. Gabrielson (1943) stresses the importance of refuges or sanctuaries if accompanied by good management. The use of refuge areas for pronghorns has proved effective, and, in special cases, may be necessary to sustain

nuclear herds. The most successful antelope refuges provide an adequate water supply, suitable habitat and sufficient varied forage. Although it is apparent that antelope can go for long periods without water and, in extreme situations, may live entirely upon the succulence of vegetative stands, water is a magnet which draws them to areas which might otherwise appear unsuitable. It is especially necessary when the animals are pressed by hunting or other human activity.

Not all open range is suitable for pronghorn. Vast tracts abutting occupied range, which to an untrained man would appear ideal, may be barren. During this study, periodic observations on several such areas failed to reveal one instance of occupancy. On others an occasional animal hurried across, as though anxious to complete a hazardous and frightening journey. Terrain covered by high sagebrush is often avoided, perhaps because the plant harbors predators and hampers flight. These experiences suggest that range which is definitely known to have been previously occupied by pronghorns should be used for refuges, as transplanting pronghorns to untried ground may not succeed. In Oregon it is rare to find pronghorns where there are only a few species of forage plants. Areas where succulents, shrubs and grasses mature at different times seem to be most acceptable to these animals. In the West, the spread of antelope should be limited to grazing lands only. Areas marginal to farms make poor pronghorn habitat. Antelope have been a source of trouble in alfalfa and grain fields and the abundant forage on such grounds shortens the life of the animal. On the Game Commission pheasant farm near Ontario, Oregon, it was noticed that when antelope were confined to enclosures where the forage was basically alfalfa, they rapidly declined in vigor and health.

Unless large areas can be acquired, a refuge will probably not be used to capacity every month of the year, owing to the continual shifting of herds. In fact, in many instances, there may be no antelope on units of 3 or 4 hundred



Federal Refuges for Antelopes

thousand acres. Refuges, therefore, should be chosen for their advantages in critical situations, rather than as year-around habitat.

The Hart Mountain Game Refuge in central Oregon, established by Executive Order of President Franklin D. Roosevelt, September 6, 1935, is a fine example of an adequate refuge. It has an abundant water supply during the critical periods of the year when water is scarce and it affords protection during hunting seasons. In winter, when heavy snowfalls may cover the surrounding terrain so that grass and browse is not readily available, the windswept slopes and ridges of Hart Mountain offer a welcome to herds that move back from the flat country to the east and south. The usual drift in winter is from the higher terrain to these flat areas, but with the advent of cold weather and heavy snowstorms, the higher plateaus or ridges of Hart Mountain may again become a feeding ground. In January 1937, when the temperature dropped to 40 degrees F. below zero, antelope herds were found on the refuge in apparent contentment, and no fatalities were reported in the herd during this period of severe cold.

Refuges or temporary sanctuaries should be located in relation to each other. For example, the Hart Mountain Refuge in Oregon is strategically located in reference to the Charles Sheldon Refuge in northern Nevada. Pronghorns drifting southward during the open hunting seasons in Oregon, find haven on the Sheldon. Does which winter on the Sheldon often return to the basins of Hart Mountain at kidding time.

Each state where pronghorns range has a few areas which are suitable for sustaining herds. These should constitute the permanent refuge units. Observation will determine changing conditions which may require supplemental action; management and alert game personnel can do much to stabilize population trends on suitable ranges. Where authority is ad-

equate, temporary sanctuaries can be chosen to bolster declining herds or to confine herds to definite areas.

Publicly owned refuges have a definite place in the management of the western pronghorn, but may need to be more flexible in the future. In Oregon there is no present need for more or enlarged permanent refuges. Local conditions throughout the West and South may require temporary sanctuaries to protect and preserve individual herds. Extensive trapping and redistribution may also require small protected areas for limited periods.

History of Antelope Hunting

Present day hunters are as harassing to wildlife as were the Indians. Weapons and ammunition have been improved; but essentially the procedure of hunting is to handicap game as much as possible to increase the advantage of the hunter.

Indians hunted antelope by surrounding them. This was necessitated by their lack of adequate weapons to cope with the wariness and fleetness of their prey. When antelope were reported in the vicinity of an Indian encampment in such numbers as to warrant the effort, the entire village, including women and children, were drawn into the chase by orders of the Chief and the exhortations of the medicine men. Hunters mounted on horses encircled the antelope herd and reduced the circle by a slow, easy gait, while the animals rushed from side to side in an ever-increasing group until all the fringes of the herd were brought into this mass formation. Their timidity prevented them from bolting the circle. Their high speed and nervous restlessness wore them out rapidly until they were finally brought to a point of exhaustion and the Indians slaughtered them with crude weapons, clubs, and stones. With the coming of the trader, muskets greatly increased their efficiency.

In comparison with modern practices, little change has taken place. The present numbers engaged in the "sur-

round" method may be greatly reduced, and are unorganized, but in effect the practice still persists. The modern hunter of this game uses a repeating rifle to fill in the gaps in the great circle, and his rapid fire is used to prevent the egress of antelope from any weak spot in the perimeter which might be found by the milling animals. Or, he may be able to force a herd through narrow passes to improve his chances, as at Slaughter Gap. He finally brings down a specimen which he has not selected, and which may not be desirable either for food or trophy purposes. This method of antelope hunting endangers the hunters, the herd, and the sport in general.

Historical references to pronghorns during the period that Oregon was settled are sketchy and infrequent. The few existing allusions indicate little interest on the part of the white man in perpetuating the species. The following item appeared in the October 22, 1886 issue of the *Oregonian*, published in Portland, Oregon:

"When the Oregon Pacific and the California and Oregon is built across southern Oregon we shall have lots of mule deer, antelope, and mountain sheep in the markets and when the Astoria and Tillamook is completed we will be provided with elk."

No record was found of either antelope or mountain sheep being offered for sale later in the Portland markets but perhaps the only reason for their absence lay in an inadequate supply.

The first game laws in Oregon were passed by legislature in December 1872. Section 1, which was amended in March 1875 to include antelope and mountain sheep, read as follows:

"Sec. 1. It shall be unlawful for any person to take, kill, injure or destroy or have in possession, or offer for sale any deer during the months of February, March, April, May, and June or any moose, elk, mountain sheep or antelope during the months of February to and including June. Penalty

of \$20 for first offense and double that sum for each succeeding offense."

A possible clue to the rapid reduction in numbers is contained in *Oregon Laws*, 1901, p. 217, Sec. 3 (*Bellenger and Cotton Annotated Codes and Statutes*. Sec. 2010). Specific provision was made for a season, but no restrictions were placed on which sex might be taken. With a dwindling stock of antelope it is logical to conclude that this omission was serious, as when both sexes are taken the females and young usually predominate in the aggregate kill. The female is perhaps more vulnerable owing to her natural tendency to protect her young.

These laws were only weak, corrective measures and did little to sustain an exploited species. Antelope herds were rapidly decimated by meat hunting and lack of practical management, and before most Oregonians realized their rapid decline, only remnants existed. It is estimated that only 10 or 15 pronghorn antelope remained on Drake's Flat in 1913 when protective measures were finally instituted.

History indicates that as the herds decreased in numbers, antelope became more wary. In the years just before the closure in 1913, even experienced hunters found it difficult to come within shooting range, and few continued the sport. Merle Jacobs, of Adel, Oregon, tells of the long, weary hours he and his brother spent hunting for antelope. They lived on Guano Creek, in the heart of antelope country which was one of the few water supplies available to these animals. Despite this and the fact that the boys were experienced hunters and skilled marksmen, they rarely came within range of a pronghorn, although they hunted almost daily. They would ride their horses until they saw one, then dismount and by the greatest stealth possible attempt to approach within shooting distance, holding their fire so as not to frighten their quarry; but they were seldom successful in killing one of these animals.

The early protective laws did not stop the sale of antelope

meat in the remote sections of their habitat, restrict the kill to bucks or make any attempt to base the harvest upon abundance. Public concern gradually increased as more people became familiar with range conditions and watched the rapid depletion of several big game species. There is a report of one man killing seven desert bighorn sheep in the Steens Mountains in central Oregon in 1907. There are no subsequent records of them. His one hunt evidently wiped out the species in that range. The persistence of the hunter is a factor not to be overlooked in conservation. Such developments resulted in the passage in 1913 of a law which offered protection to diminishing species as follows:

Chap. 232, General Laws of Oregon, for 1913 Sec. 4, p. 427. "It shall be unlawful within the State of Oregon at any time to hunt for or have in possession any mountain sheep, mountain goat, antelope, elk, moose, caribou, beaver, female deer or spotted fawn or young deer of the first year or any portion thereof, except for scientific, breeding or other purposes, as herein expressly provided."

Section 62 of the same chapter, p. 456, provided a penalty of a minimum of \$200 or maximum of \$1,000 or a jail penalty in lieu thereof of 60 days minimum or not more than 6 years. To this was added a civil liability upon conviction. Not less than \$100 or more than \$200 was to be assessed for killing an antelope. (*General Laws of Oregon for 1913. Chapter 232, p. 432.*) This law was seldom used. Its effect still remains doubtful.

As with all remnant species, increases were slow at first. An annual 10 per cent increase in a herd of 20,000 seems significant. In a herd of 10, it seems trifling. This was true in Oregon. The process of herd rebuilding was gradual, as the animals were subjected to illegal killing and natural hazards. About 1920, it became apparent that the increases were gaining momentum. From about 1925 to 1938, the herds grew rapidly in size, at a rate that seemed stabilized. There were rumors of phenomenal increases and fantastic estimates of

abundance before 1938 when it was finally decided that a small harvest could be allowed. This was awaited anxiously by field workers.

The antelope proved to be victims of habit. They appeared to be lulled into a sense of false security by 25 years of protection, for when the season was reopened, they had little fear of man. It was apparent from field observation before the reopening that the herds would be quickly decimated unless some limit was placed on the number of animals to be taken. This proved a wise decision, although the pronghorns' re-education was rapid. In the 1938 season, hunters concentrated on Drake's Flat. This is a wide sweep of uniform, low rolling hills, about 22 miles long and 10 miles wide, with immense stretches of open plateaus, several of which extend for 3 to 4 miles before dropping off into gullies or rising abruptly to higher levels. Naturally this amphitheater was favored by the antelope because of visibility.

At daylight on October 28, the antelope were scattered in small groups over the Flat. Since there are many roads, hunters were also scattered at random throughout the area, and began firing in the murky dawn. As visibility improved, antelope could be seen running here and there across the basin as they sought safety. This brought them within range of most of the hunters, many of whom were hunting antelope for the first time. They shot from distances averaging 400 yards and there were few attempts at stalking. This incessant shooting caused the animals to band together in fear, until at the end of the first day there were several herds of 100 or more pronghorns on the plateau. On the second day the concentration was more marked, and the process continued until November 1, the fifth day of the season, at which time one herd of 341 antelope was seen. This was a precarious position for the antelope, and would have been most serious if there had been no limit on the number to be taken. Obviously, there was a loss in addition to the actual number of antelope taken into possession. Shooting at ran-

dom into concentrations caused injuries to animals which were not retrieved and it was estimated after the close of the season that the total kill was increased at least 20 per cent by this practice.

The helplessness of the antelope resulting from their long protection was anticipated. In the hunter an interesting reaction was noticed. Were the antelope then such wary animals? Could he not bag his antelope next year by the same methods, or would pronghorns learn by this experience and finally better adjust themselves to the periodic season of persecution? Game workers wondered also. Ensuing seasons have partially answered this question. The 1939 season opened with about the same field conditions and the herds were distributed much the same as in the previous year. The opening date, however, was earlier, and the season lasted 3 days (October 6-8) instead of 5. The 1938 season had proved too late from a trophy standpoint, as the bucks were in poor flesh and the horn sheaths were already loose or in some cases already shed. It has been difficult to set the antelope season early enough in Oregon to secure prime animals as there is continuous pressure for concurrent big game seasons. These requests are made on the grounds that most hunters prefer to make one trip annually to the hunting grounds when they can take several species of big game. But this is a wasteful and unscientific practice.

Basically, the procedure in 1939 was the same as in the 1938 season; but with another restriction, prohibiting hunters from shooting from their cars, or from within 150 feet of their cars. The object was to prevent them from actually racing with the animals to bring them within range and then shoot at them while they were in full flight, a practice which accounted for most of the cripple losses of the previous year.

The kids of the year were, naturally, unaware of the hunting menace. This was not true of the adult animals which had experienced the 1938 season. They had learned to be afraid of human beings, and as early as the morning of the

second day were drifting away in small bands to leave the flat country. At 10 o'clock on October 7, a band of 140 antelope, strung out over a mile, was seen drifting into the hills, following sheep trails and deer runways back into the mountain meadows. On October 8, while reconnoitering in the highest country, observers found antelope in the shelter of the peaks at an elevation of about 8,000 feet. In one instance, a buck seeking escape from his mountain hideout just under Crook's Peak disappeared into the heavy pine timber and was later seen emerging from the dense pine forest onto the desert sage flats a mile below, having traversed the forest with speed and ease. The animals must have profited by the experiences of the previous year, for they stopped banding into such large herds as they had formed the first season, depending instead on flight for protection.

About 1,500 hunters were concentrated in this same range on the opening day of the 1941 season. Only one small herd was on the range. Few escaped the barrage laid down at the first streaks of light as the season opened. The average range was about 750 yards, much too long to encourage skill, and naturally, accuracy was in direct relationship to the distance.

Obviously, there were too many hunters for the area, and although no records of personal injury were reported, one hunter barely escaped death when a rifle bullet passed through the car in which he was asleep and lodged itself in the back of the front seat just 10 inches above his head. This occurred before it was light enough to see the targets distinctly and most of the shots taken were ineffective.

Most of the shooting was at Slaughter Gap and at other points south of the Plush-Lakeview road. Few animals were wounded and wasted, because a wounded animal could not escape this army of hunters. Even if a pronghorn fell a long distance from the hunter who shot it, another of the numerous nimrods quickly claimed the spoil.

Another practice, contrary to good sportsmanship, developed that season. The night before the season was to open,

hunters took sleeping bags and placed themselves on the rim of the basin at many points surrounding the grazing herd, occupying all passes and leaving no ground uncovered whereon the antelope might find refuge. The result was that within a few minutes after the season opened, most of the antelope were killed. In many cases the hunter was still in his sleeping bag taking random shots as the indistinct animals moved by in the murk of early morning.

The history of the Drake's Flat herd shows a rapid downward trend during the period covered by this study. At the end of the 1941 season, about 345 head remained of the original 2,500 which used the range in 1938, before an open season was declared. These remaining antelope broke up into smaller groups and joined other herds on such ranges as Big Valley in Oregon, and the Modoc County areas in California. In this instance it is evident that hunting pressure did not force pronghorns into more protected or better areas. The most suitable ranges lay to the east and north, but the herd pressed to the south into areas more vulnerable to hunting pressure and human molestation.

The reduction in this herd resulted from using this habitat for hunting almost to the complete exclusion of many other areas not hunted for 25 years. In many such places antelope were equally as abundant and accessible, and better specimens could have been taken, since herds long unmolested contain more mature bucks and incidentally finer heads. Although many fine hunting regions were thrown open to antelope hunters in 1938 and 1939, with even greater choice in 1940, they continued to concentrate on Drake's Flat because they could reach it easily. Most were successful in bagging antelope but paid little attention to maturity, quality, sex or trophy value. This is not an isolated instance of the need for strict control of game harvests by the management personnel. The relaxation of restrictions on species which are low in number may prevent them from again becoming a game species. Nation-wide failure to protect wildlife adequately

for only one season could reduce some species so greatly that it would be impractical to attempt their restoration.

TABLE 12.

Drake's Flat—Mule Lake Antelope Herd

<i>Year</i>	<i>Preseason Census Number</i>	<i>Total Kill¹</i>
1936	1,900	0
1937	2,300	0
1938	2,500	150
1939	2,100	250
1940	1,700	550
1941	820	475
1942 ²	200	0
1943	75	0
1944 ³	68	0

¹Including open season and delayed kills.

²No open season 1942-44.

³Comprehensive airplane and ground census.

The Problem of Meeting Hunters' Demand

Hunting as a recreation is increasing yearly in popularity. The result is a demand for more and more game, which cannot be satisfied unless the take be carefully regulated. American sportsmen have continually claimed certain "rights." Title to natural resources rests in all the people, however, and if restrictions to prevent waste and permit increasing returns are desirable, the small minority who hunt should be willing to accept them on the logical grounds that sustained returns, however small they may be, are thereby assured. It is only by regulatory means that wildlife can be maintained for hunting, and these must often of necessity be more stringent than sportsmen would recommend. Regulations which are too liberal may seriously reduce future game populations. The problem of the conservation officer then, is to guard the wildlife of the United States to provide sport for the greatest number of people. This task some-

times appears to consist of heroics in protecting it from annihilation.

There has been an increasing tendency to travel long distances for big game hunting. For instance, big game licenses issued in Wyoming in 1943 totaled 10,436, of which 8,294 were residents and 2,142 or about 25 per cent, were nonresidents. Almost every section of the United States was represented. With such widespread interest, it is obvious that conservation, which is to say the careful husbanding of game crops, is of national as well as of local concern. The fact that a species may always be so restricted in abundance that it cannot be hunted except under rigid rules is no reason why it should not be carefully managed. As years pass more game species will face just such conditions. The best course is to recognize this now, and adjust our thinking accordingly.

Sportsmen, in their enthusiasm to take game, often fail to consider that enough breeding stock must be left to perpetuate the species and that some correlation of the harvest with the number of hunters and amount of game is essential. This has been particularly noticeable immediately after exotics have been introduced. Usually there is a clamor for an open season long before this game is sufficiently abundant. The same is true of "creel thinking" fishermen. When streams and lakes are artificially stocked the general belief is that the area will be thrown open in about 2 years, when in fact 5 or 6 years may be required for the natural reproduction necessary if the species is to maintain itself, even in the habitat best suited to it.

There is a similar problem in handling remnant game forms. Public pressure often fails to take into account the reproductive limitations of a species. It is time to be frank about such remnants and say that only a limited number of hunters can expect to be successful each year. The Oregon Cooperative Wildlife Research Unit has vigorously contended, since its establishment in Oregon, that two of the big

game species of this state, the elk and the pronghorn antelope are outstanding trophy animals. They are by nature restricted to ranges suited to them, and are not numerous enough to satisfy the hunters. Both of these species should be managed on a controlled plan, with the fee for permits fixed high enough to pay for costs.

The total number of antelope which can be maintained in Oregon probably will never exceed 30,000. There are now about 90,000 big game hunters in the state, judging from records of license sales. The average antelope kill in the future can hardly be expected to exceed 500 per year, with slight increases determined by annual inventories. Even in years when herd decreases are desired, this average kill will probably not be increased by 100 per cent. Obviously, the pronghorn will be available to only a few of these hunters. Other game species, principally the mule and black-tailed deer, are in sufficient numbers to provide sport for the big game hunter. If the antelope can be elevated to the status of a trophy animal, with emphasis on the sport rather than the meat to be obtained, the species can be perpetuated. A conservation management program will assure a consistent number of trophy or sporting antelope annually without dangerously reducing the herds on ranges where little else could be produced.

Increases of antelope during the past 40 years have been most encouraging. Still, the animal has not yet occupied all of the range available where it can live without conflict with human beings. As a result of these increases during periods of protection, several states held unrestricted seasons. In most instances, these harvests were followed by another protective period, to save the species from complete extirpation. Wyoming had this experience. Allred (1943) reported as follows:

“Through the years of protection by closed season, pronghorn populations increased until in 1926 there were reported 21,885 antelope in the State. The first Wyoming antelope



Figure 44. Typical sagebrush flat. Winter feeding area, Lake County, Oregon.



Figure 45. An example of the close cropping of brome grass by antelope, Lake County, Oregon, January 27, 1941. Note that the remaining shoots are less than 1 inch in height. Photographs by author.

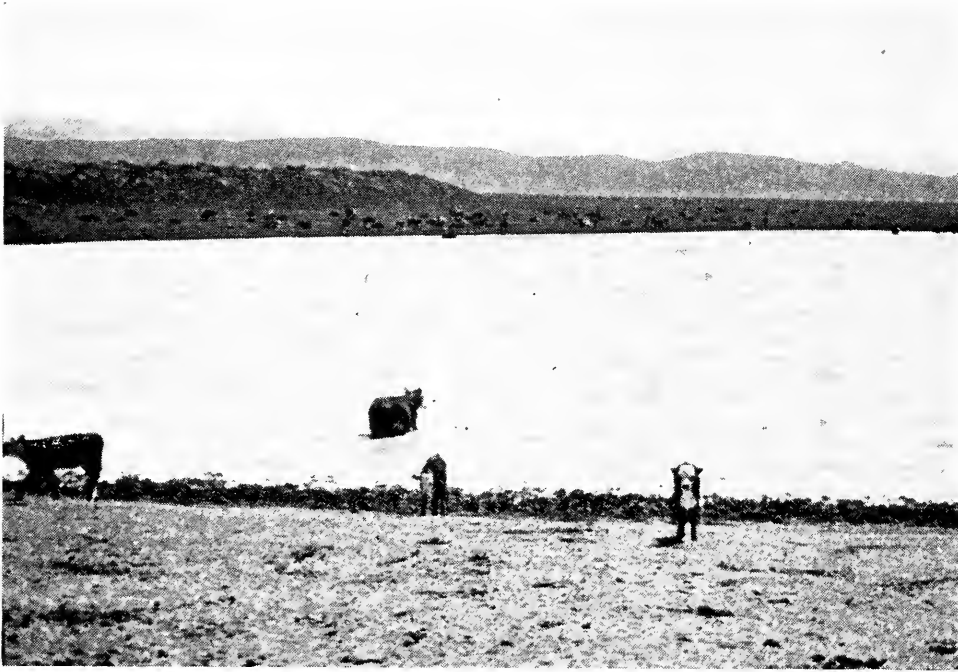


Figure 46. Natural alkaline lakes are heavily used on the arid ranges by both domestic and wild animals. Photograph by author.



Figure 47. Oregon pronghorn range. Its physical properties are found

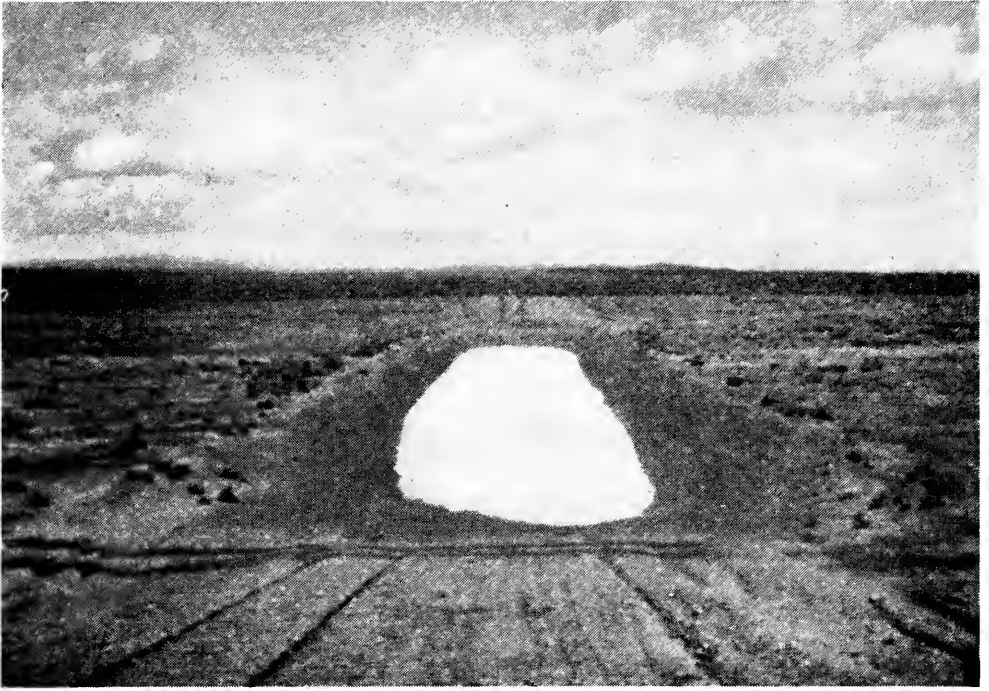


Figure 48. Waterhole dug by the U. S. Grazing Service, commonly used by pronghorns and other desert game. Photograph by author.



in many areas in the West. Photograph by Eugene C. Starr.

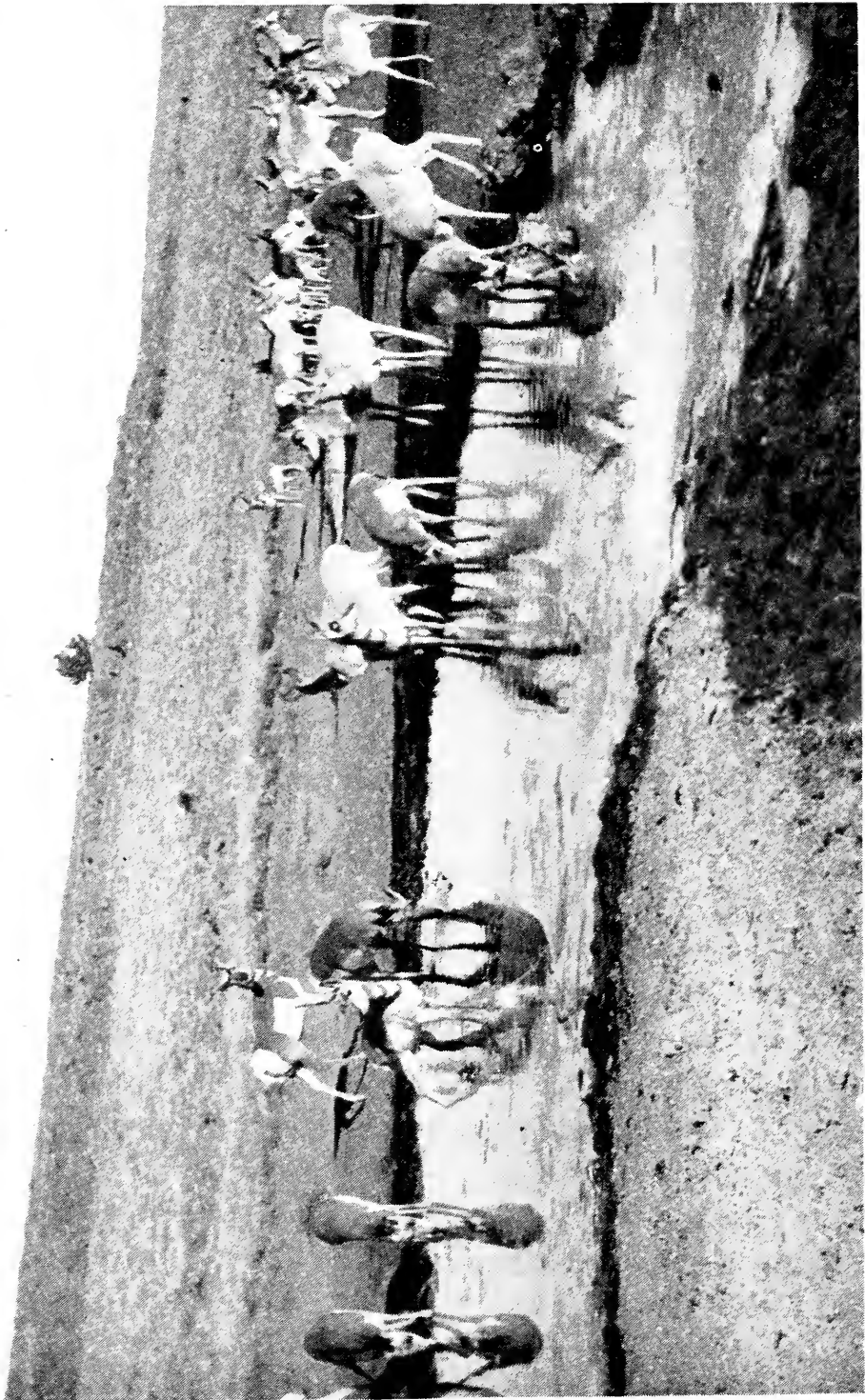


Figure 49. Antelope on the Charles Sheldon Refuge, Nevada, 1936.
Photograph by E. J. Greenwalt, U. S. Fish and Wildlife Service.



Figure 50. Antelope wading on the Charles Sheldon Refuge. Photograph
by E. A. Greenwalt, U. S. Fish and Wildlife Service.

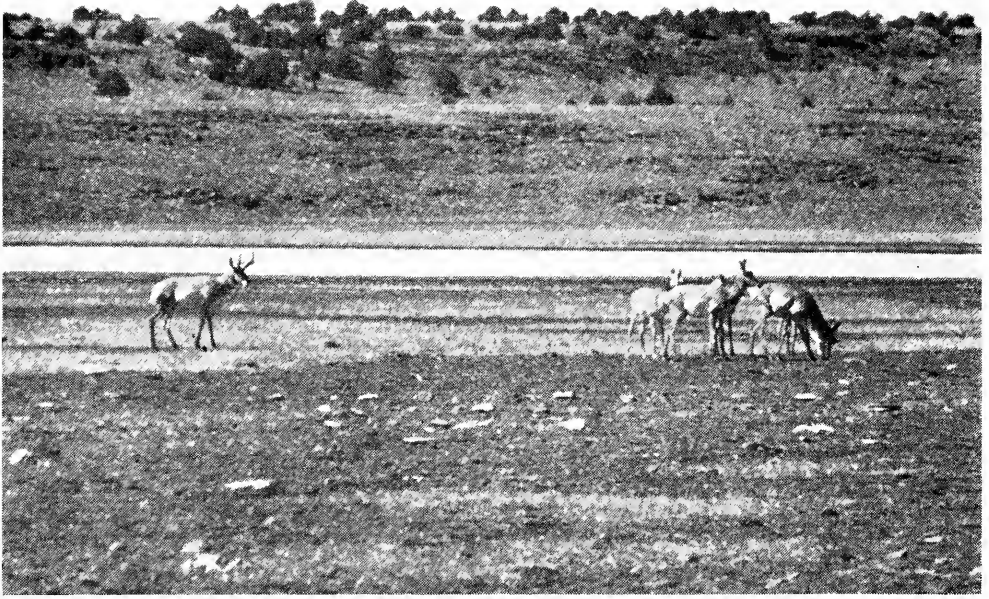


Figure 51. A family of pronghorns coming to drink at a receding desert lake.



Figure 52. Pronghorns come to a desert stream to drink, but do not destroy vegetation. Photographs by George B. Cox.



Figure 53. Cattle have destroyed most of the vegetation along this stream. Only the thistles remain.

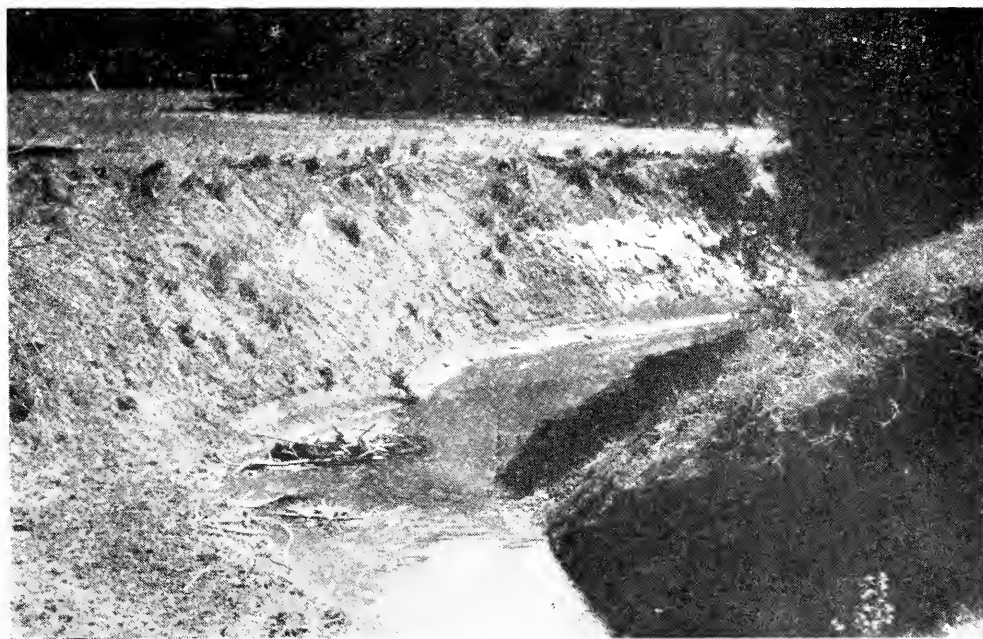


Figure 54. The same stream, showing effect of overgrazing, with stream bank cutting and lowered water table. Beaver forced to abandon water storing. Photographs by author.



Figure 55. A desert fence successful in turning antelope from farm meadows. Note the well stretched wires. Photograph by author.



Figure 56. A range fence upon which cattle and pronghorns are exerting heavy pressure. The latter slip into the meadow easily, since the wires are slack. Photograph by A. V. Meyers.

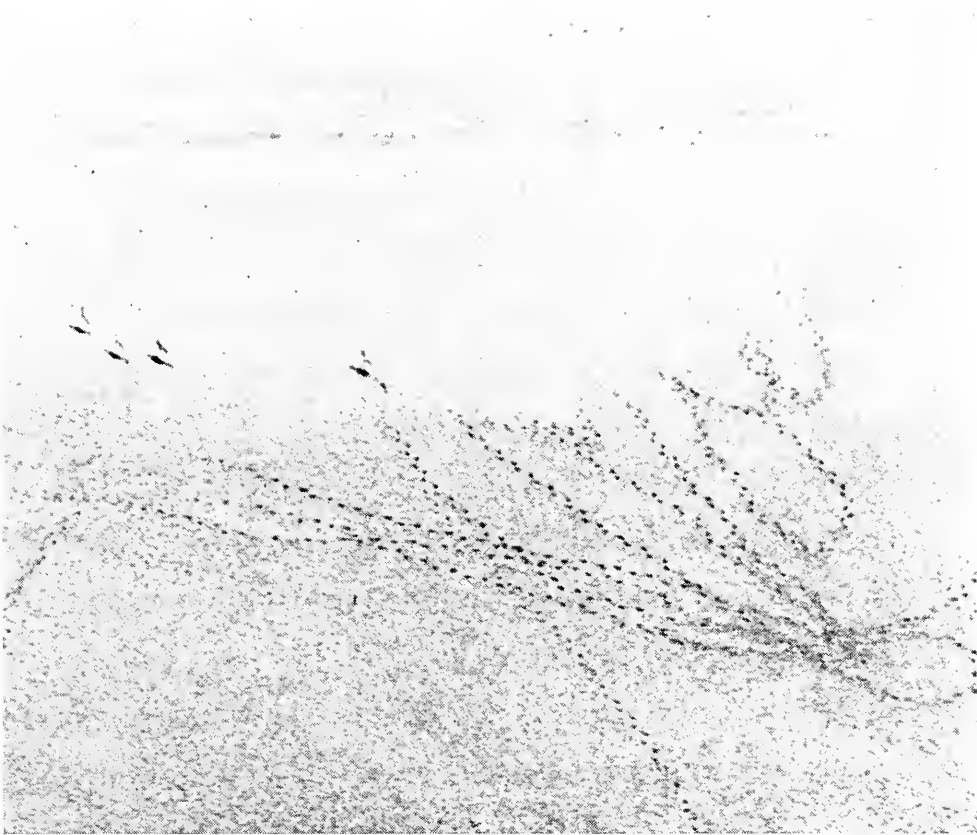


Figure 57. Pronghorns leave a dry lake bed. From the air, antelope tracks can be distinguished from those of domestic animals. Photograph by John McKean.

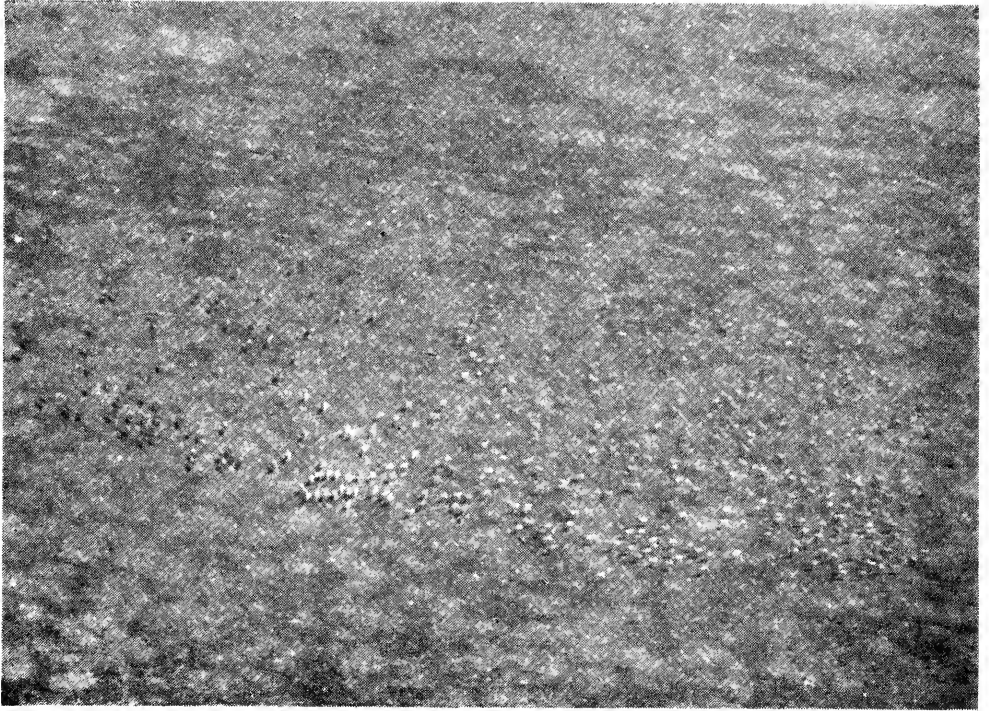


Figure 58. Light effect on antelope photographed from the air at 1,000 feet elevation. Pronghorns in center foreground have turned so rump-patch attracts attention.



Figure 59. Aerial photograph from 50 foot elevation. Note difficulty of sex determination. Photographs by John McKean.

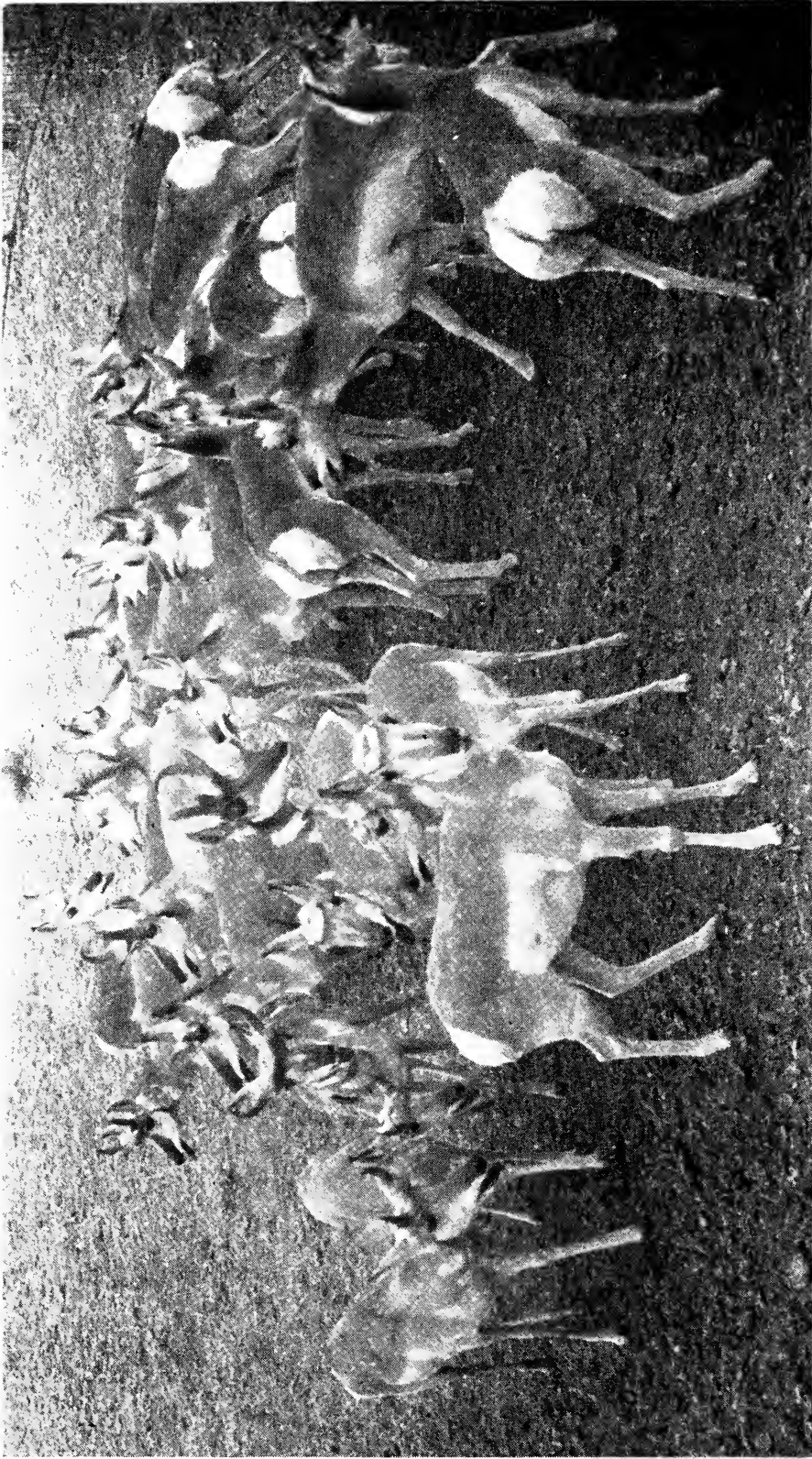


Figure 60. Pronghorns in the trap. Photograph by the Texas Game, Fish, and Oyster Commission.

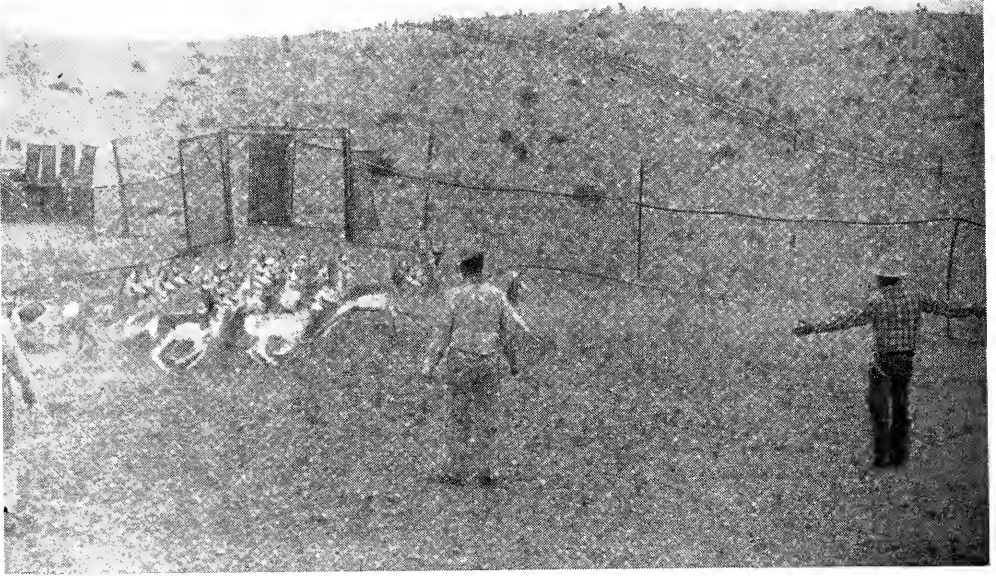


Figure 61. Pronghorns being worked into the "catching pen."
Photograph by Nils Nilsson.



Figure 62. Catching pronghorns for crating and shipping. Photograph by the Texas Game, Fish, and Oyster Commission.



Figure 63. About to be crated, these pronghorns are destined soon for a ride and a new home.



Figure 64. Game managers of Texas tagging (in ear) pronghorns. Photographs by the Texas Game, Fish, and Oyster Commission.



Figure 65. Even at a considerable distance, the face mask of the buck is an obvious method of determining the sex.



Figure 66. The light coloration of the doe's face is apparent if a hunter will wait until he can distinguish it (yearling doe). Photographs by author.

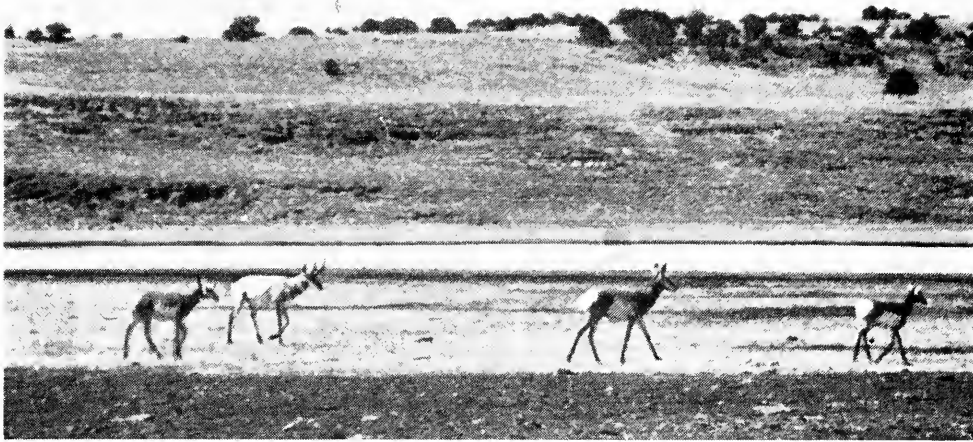


Figure 67. Antelope in typical poses. The forward rake of the buck's horns and the low nose are most natural. The doe ahead of him carries her head with the nose higher, and even in the distance this dissimilarity is marked.



Figure 68. Showing black neck patch below level of eye on yearling pronghorn. On mature bucks the neck patch is much more obvious. Photographs by author.



Figure 69. Game biologist salvaging antelope found wounded at end of day's hunt. Photograph by author.

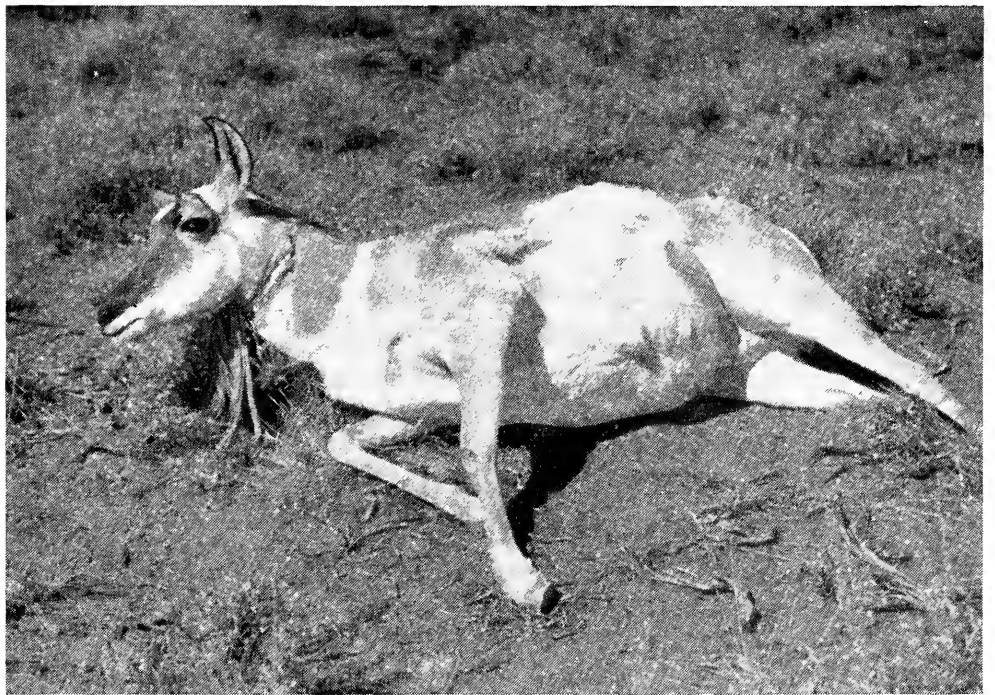


Figure 70. Pronghorn doe, dead less than four hours, but bloated and unfit for food.

season in 18 years was accordingly opened in 1927, when 471 resident and 29 nonresident antelope permits were issued. The census of 1929 estimated that there were 26,625 antelope remaining. In that year, 6,353 antelope were killed in 12 counties. During this season antelope were practically depleted in the four counties west of the Green River. The 1940 census showed there were not more than 92 antelope in all this region. The public reaction to the open season was, therefore, decidedly unfavorable, not only in the State but over the nation as a whole where conservationists had long been watching the Wyoming pronghorn populations with much interest. Public sentiment over this incident was in a large measure responsible for the revision of the Wyoming game law to give the State Game and Fish Commission discretionary power in regulating game-animal bag limits."

These facts do not portray the full picture of waste and poor sportsmanship. In many instances antelope were pursued by hunters in automobiles until they dropped from exhaustion and were shot where they lay. Others were forced into fences or run off ledges to injure themselves in the fall, never to be retrieved. Wyoming quickly reversed its liberal policies, and gave greater protection to the pronghorn.

Since 1938, Oregon has had an open season on antelope, with a limited number of permits issued. The proportion of successful hunters—the "success ratio" has varied yearly from 38 to 73 per cent. Except in unusual situations, such a high figure is possible only with a species which inhabits open range. The antelope is particularly vulnerable, and an unrestricted open season could destroy the entire species within a few days. Animals which are by habit elusive or which live in dense cover are more protected, and the success ratio is usually much lower. In some of its more productive years, Oregon provided deer for about one-third of the licensed deer hunters, while in other years only one-fifth of the hunters were successful. The more primitive game areas of the West naturally provide greater opportunity for success.

Pennsylvania's kill of white-tailed deer in 1943, reported in the *Pennsylvania Game News*, January, 1945, totaled 38,882 (23,931 bucks; 14,951 does) or 1 deer to each 6.5 hunters, a success ratio of about 16 per cent. This is typical of most big game kill ratios. It is impractical to believe that a management plan could be so productive as to provide a 100 per cent success ratio to hunters each year. High success ratios persist only when hunting of a particular species is controlled with a definite number allocated for harvesting. In most instances, such a plan imposes definite restrictions as to where and how allotted animals may be taken.

TABLE 13.

Oregon Antelope Tags and Kill, 1938 to 1944 Inclusive

<i>Year</i>	<i>Kill</i>	<i>Tags Sold</i>	<i>Cost</i>	<i>Tags Authorized</i>	<i>Per Cent Successful</i>
1938	175	274	\$5.00	1,000	59
1939	214	293	5.00	600	73
1940	399	554	5.00	1,500	72
1941	1,378	2,998	1.00	3,000	45
1942	¹ 594	1,108	3.50	1,500	53
1943	691	1,205	2.50	2,500	57
1944	728	1,894	2.50	2,500	38

¹Antelope season closed with end of first day of season on account of fire conditions. This is proof of intensive hunting during opening days—usually 70-80 per cent of total kill is during the first days of season.

Management of Hunting

Pronghorn hunting, if properly conducted, is an incomparable sport. Hunts on the North American Continent can be as thrilling as those on the Gobi Desert. These animals occupy definite ranges and may be visible at a distance of 2 or 3 miles. In this day of modern conveniences, a telephone conversation even on the 10-party lines of the outranges may determine the location of a herd, and a few moments later the hunters can be on the occupied range. If herds are to be maintained, it follows naturally that safeguards must be adopted to insure abundance. It is necessary to know the life history of the pronghorn in every

range where it is found, before sound management can be practiced. Up to the present, few states can claim an effective and established pronghorn management program. Colorful propaganda to the contrary notwithstanding, there are no known instances in which the management has adequately maintained optimum numbers of this species on a sustained yield basis.

California, in 1942 and 1943, used a permit system, awarding 500 permits on a lottery basis. This was done by accepting all requests for permits and at a specified time a lottery was held to choose 500 names for permits. Each year applications ran into the thousands. In this impartial manner the desired number of hunters was selected. This is a good example of sound management practice, as it not only protects the herds but satisfied the hunters. The conservative approach was wise, as the herds had been long protected. As indicated in Table 13, the average annual increase is extremely low. This is all the more obvious when it is realized that herds on ranges in adjoining states may have been considered in the totals for both states if census crews did not coordinate their activities.

As biologists of pronghorn states find an established harvest a wise management step, they learn the need for giving detailed hunting instructions. Following are excerpts from the *Instructions for Antelope Hunting in California in 1942*:

“Remember the Following:

No shooting from cars.

No chasing with cars.

No male antelope to be shot with horns shorter than ears.

No female antelope shall be shot.

No camping near stock water.

No transfer of permits.

Remember you must check in at checking stations and after hunting check out, turning in your card report.

Do not bring friends with you who have no permits.

Do not leave gates open.

Do not make a nuisance of yourself.

Hunting licenses must bear antelope permit number.

Evidence of sex must be left on hide.

Hide must be retained for ten days after close of season.

Antelope, unlike deer, have a gall bladder, so look for it when you dress your animal."

Although many of these points seem self-evident there is an apparent need for such plain talk.

In addition to specific hunting instructions, the California Game Department included rules for individual conduct. Unfortunately, the lack of field ethics is widespread and California's action in this case is commendable.

Alternate open and closed seasons in the pronghorn states are direct proof of the severe fluctuations in numbers whenever hunting has been permitted. Herds are scattered or pushed into new habitat, often in adjacent states. There are numerous examples of wasteful harvests which either entirely eliminated the antelope or drove it from good habitat.

It is with these facts in mind that new management procedures have been devised, carefully regulating how, when, where and by whom these animals may be taken. The suggestions are evolutionary in nature, formulated as a result of observation of hunting practices in Oregon from 1938 to 1944.

The vastness of the range inhabited by pronghorns complicates the management of them. Although regulatory measures rest within the states, except on federal refuge units, the herds may cross state boundaries so that an inventory conducted by one state may indicate considerable reduction in populations, while that of an adjoining state shows surprising increases. Any harvesting plan must be in direct

relationship to abundance since the trend varies from year to year. Inventories by trained game workers, occurring at least twice a year, are necessary to determine the number of animals that can be harvested each year and still sustain populations. By this means information can be obtained as to abundance, location of herds, range conditions and other pertinent information before the time for setting the hunting season.

There are several other factors which make frequent inventories advisable. A severe winter, or late spring, may reduce the herds by predation, starvation, or exposure. The size of the kid crop may vary, depending on whether single or twin kids predominate, and this may have an important effect on numbers the following year. In Oregon it has proved advisable to make a census in March or early April before the kidding season, as the seasons are set in July according to state law. Another census is made in late summer just before the hunting season, when large concentrations may be found near waterholes. This will determine the survival of the kid crop. In other states this time may vary based on local conditions and regulations.

The Hunting Season

The ideal time for hunting antelope in Oregon is in August, preferably before the 15th. Bucks are in excellent condition then, in quality of the meat, and in the head and horns. As it is recommended that only bucks be shot, the early season will not affect the kids, even though they are still nursing. An open season permitting the kill of either sex could not be held in August without a great waste of young animals; but if hunters were informed enough to identify sexes in the field, the season could fall before the bucks enter the rut, with hunting grounds under better control by game personnel assigned to this problem only, since few other duties interfere at this season.

In the past, pronghorns in Oregon have been hunted in

the fall after the mating season. The first Oregon pronghorn season in 1938 lasted only 5 days (October 28 to November 1, inclusive). These dates were selected at the request of the game protective division of the state police (the agency responsible for enforcement), to follow the closing of the other big game seasons. Since then the pronghorn seasons have all been held a few days *before* the deer season, or concurrently with it. There was no studied plan to hold overlapping big game seasons; but from 1941 to 1945, when the use of game to supplement food stocks was important, this practice was continued as an emergency measure, enabling big game hunters to hunt both deer and pronghorned antelope on the same trip. This plan is wrong.

The late season has little to recommend it, except that if both sexes are to be shot, which is advisable only when it is desirable for some reason to reduce herds, kids of the year are better able to adjust. A late season may also benefit the novice in saving his meat, even though with present available information and facilities, proper care of the carcass even in warm weather is not difficult.

Although there is a natural inclination for sportsmen to prefer long hunting seasons, there is ample evidence to prove that the largest portion of the big game kill occurs in the first few days. Ninety per cent of the Columbian black-tailed deer kill in the Pacific Northwest occurs during the first week of the season, probably as much as 70 per cent of it in the first 2 days of the season. Arizona has reported (*Pittman-Robertson Quarterly*) that in the 1942 antelope season, which was rather a long one, 74 per cent of the entire kill had been made by the end of the second day.

Pronghorns are limited to range where conditions suit their peculiar needs. If there is no escape route, the animals pass in front of the guns again and again during the hunting season. To eliminate the danger of complete extirpation of a herd, the season on each range should be short, preferably 3 and not more than 5 days. Permits may be issued for

specific days to individual hunters if a longer season is chosen, and should always limit the hunters a certain range. Thus the number of permittees on the hunting grounds can be controlled in order to avoid panic and stampede in the herds. Liquidation of the Drake's Flat-Mule Lake herd appeared to be a combination of the two obvious effects of hunting pressure on pronghorns—heavy kill, and dispersal from the range. Wyoming and other western states experienced similar results, if current reports are well founded.

Size and Location of Hunting Areas

Proof that hunting must be conducted under strict rules rests in numerous reports from the entire antelope range. Edward W. Nelson, in "Status of the Prong-horned Antelope, 1922-24," tells of an experience in Texas in 1922, when antelope were faced with excessive hunting pressure:

"On May 1, 1922, Mr. Boyd wrote that the antelope in Texas were ranging, so far as possible, in the rougher or sandy lands, owing to their having been hunted in high-powered automobiles."

More recently in Oregon hunters have driven pronghorns into mediocre range.

In 1941 Oregon ranges had the most abundant water supply since 1938, when the seasons were opened. The result was a general scattering of antelope, and favorite concentration areas of previous years now held only a small portion of the entire population. A portion of range adjacent to Fish Creek, at the southern part of Drake's Flat, held less than 100 individuals, which were killed shortly after dawn on September 28, 1941, the opening day of the season. Many of the hunters who were familiar only with this area went home without seeing an antelope, while in fact they were very abundant a few miles away. Many small herds roamed unmolested during the 8 days of that season.

If the hunting area is large enough to allow dispersal of hunters over considerable territory, a more equitable harvest will result. It should also be large enough to justify the maintenance of a checking station and field observers. These units cannot encompass a fixed number of acres. The rule must be flexible enough to meet local situations.

Location of hunting areas can be determined by the game management workers assigned to this problem. Rolling terrain is preferable to flat saucerlike basins or plateaus and affords a greater number of shots to the skillful, stalking hunter, as the antelope drift near draws and ravines where the hunter may wait in concealment. This is also better opportunity for a good shot as the animals are not so excited. Open country is dangerous to the hunter because of the great distances from which shots are fired and because of lack of protection. A gunner may accidentally place another in direct line of fire, completely unaware that he may be endangering another man.

Slaughter Gaps or Runway Bottlenecks

During antelope hunting seasons in Oregon it has been observed that type of terrain and antelope habits must be considered in selecting shooting areas if the animals are to be adequately protected, and if the hunters are to enjoy the fullest amount of skill and sport without jeopardizing future abundance. On each hunting area the pattern of antelope flight is circumscribed by habit established through years of range usage. On Drake's Flat, rolling plateau at an elevation of 5 to 6 thousand feet, most of the grades are gradual, and the area, about 22 miles long and 10 miles wide, is cut by ravines and a few watercourses. When intimidated, antelope restlessly shift through this entire area. At 30 miles an hour the length and breadth of the plateau may be quickly transversed and if continually molested pronghorns will work nervously from one shelf to another.

Early on the first day of the season the bands are scattered, since they have been feeding in widely separated spots. As the day progresses, the bands on restricted basins become larger and larger as the animals seek each other in fear, until by the end of the season (if it be of several days' duration), these herds concentrate into large masses which are particularly vulnerable to herd shooters.

When fleeing from human beings, antelope use well-defined paths. The draws are the natural crossing points from one range to another; and only on the rarest occasions will antelope cross on high slopes or around prominences or buttes. To the east of Fish Creek watercourse lies a rugged draw, and beyond it is a broad plain extending from Drake's Flat-Plush Highway to a point 5 miles due south. About a mile south of the highway, two ridges form a gap nearly a quarter of a mile wide, and if one stations himself in this gap when antelope occupy this range and the shooting season is in progress, he will see innumerable pronghorns pass through during the day, seeking a spot unoccupied by hunters. This flight is almost continuous. Small bands seeking to join the great herds will run back and forth. Bands intercepted by hunters will split into small groups and as they crowd along, will pass through this critical bottleneck, which because of its history as a shooting ground has been named "Slaughter Gap."

Similar runways will be found in any antelope country. The habit of antelope to string out, single file, following their leader regardless of imminent danger, makes it imperative that all hunting areas opened for the first time be carefully watched; and any ground which because of its natural topography constitutes a "trap" should be set aside as a refuge island. This adjustment will make antelope hunting a sport, rather than a slaughter. Flock shooting in narrow defiles will destroy the species if it is allowed to continue.

The Special Permit

The use of a special permit for antelope hunting in addition to the hunting license is one means of restricting kills to surplus. Authority for such restrictions must rest with the game department, rather than with a state legislature, which is powerless to act in an emergency. Control of the harvest by manipulating the size of the fee for these permits proved feasible in Oregon. Records indicate that the low permit fee was partly responsible for the unusual number of hunters concentrated in the antelope country in 1941, when the Drake's Flat herd was decimated. That year 2,998 of the 3,000 tags authorized were sold. It was apparent from observations in the field during previous hunting seasons that Oregon did not have 3,000 people who could be considered skilled antelope hunters, and the sale of so many permits engendered disorganized hunting. When the fee was again increased, fewer permits were sold and a more qualified group of hunters roamed the rangelands.

Complete reliance on such a method to regulate the harvest is not recommended. It can only supplement more specific regulations designed to meet field conditions. To draft here an adequate set of regulations applicable to any range is obviously impractical. Each antelope range may have conditions peculiar to it, requiring specific treatment.

Possibilities of Pronghorn Distribution and Perpetuation

Although in geological history the pronghorn antelope has been represented by fossil remains in areas east of the Mississippi River, notably Wisconsin and Illinois, it was found by the traders, trappers, and early explorers to abound principally west of the Mississippi River. It was a vast territory. The area comprised arid plains and rolling plateaus, whose eastern boundary was determined by the weather influence of the Mississippi River Basin. For the want of a better designation it has become known as the

western United States. Considering its early and present distribution, the pronghorn seems to offer much as a game animal since it is now found to occupy the same extensive range determined as suitable habitat by the first "coureur de bois." With the possible exception of Kansas, nuclear herds can be found in every state west of the 100th parallel of longitude and even in those states bordering the Pacific Ocean.

Pronghorn distribution in North America may be mapped as a series of herds in the area west of the 100th parallel of longitude, and lying like a big letter "U" with its two tips in the northwest and its base resting in Mexico. The range now occupied reaches up into Alberta and Saskatchewan, through Montana, western North and South Dakota, into Nebraska, Colorado, Texas, and New Mexico, with its Mexican cousins established in the State of Chihuahua, westward into Sonora, Lower California, Arizona, Utah, Nevada, and back into Oregon. The grading off into subspecific groups within this range is merely the reflection of climatic and topographic influences, a good example of animal variation due to ecological changes.

In the evaluation of the game possibilities represented by the various wildlife species, there is much that is disheartening. Anyone in whose veins there courses a drop of pioneering blood, the outdoor love of the naturalist, or the curiosity of the explorer, cannot help but feel pangs of regret over the loss of many of our game species. Some may have been thrilled by the sight or memory of the bison. It was a game animal incapable of adjustment to an agrarian population. Gone, too, from the vast prairies are all but a remnant of the prairie chicken. Only in limited areas does the sage grouse hold a permanent place in the annual game crop, and in their stead in the stream-fed valleys has come the exotic ring-necked pheasant to skulk in the alfalfa or cornfields. The waning of these species reflects some weak link in their association with mankind. It is what man does that seals their

doom. Ecological successions following the plowman are recognized now as a factor affecting survival of the prairie grouse. The lack of timidity of these birds, too, is often a fatal handicap where human populations swell. It is quickly obvious to the observer that wariness is an essential attribute in this modern age. The survival of the waterfowl whose yearly orbit swings them through centers of population and even puts them down on the margins of our great cities, offers a good example of the value of timidity. The ring-necked pheasant which lives in the dooryard of a busy gardener, a pattern reflecting early experiences on the handkerchief-sized rice paddies of the Chinese farmer, offers further evidence that wariness and self-sufficiency are needed in the fight for survival.

In the most of the Western States the pronghorn ranges today on the same habitat where it was found at the beginning of the last century. This speaks well for its staying power and indicates that this distribution can be maintained so long as the activities of man are not detrimental to it. Gone forever are the often mentioned "good old pioneering days"! It is a simple deduction that there is little comparison between the past and the present. In the past, a handful of hunters faced millions of pronghorns if early reports are correct. Now the existing pronghorns if exposed to unrestricted hunting would not survive one day's efforts by the well equipped and numerous license holders. It is time to substitute other values in hunting, emphasizing improvement in skill and wider appreciation of those attributes of aesthetic worth.

Another impending danger is that of farm fences. When wire netting is used to enclose small tracts, a practice which will eventually occur in some parts of the northern prairie states at least, the pronghorn will be driven from its original range to less restricted areas.

Where pronghorns have not been pressed by civilization into unnatural habitat, they will be found well established

at elevations from 3,000 to 6,000 feet even where vegetative growths are sparse. Since such conditions prevail throughout much of the West, it is natural to presume that in the coming years, the distribution of the species will vary little except as human intervention restricts their range or re-establishes them in new localities. Vast acreages lie in the far Southwest, which, because of the sparseness of vegetative stand, offer little possibility of ever being divided into small plots by netting fences, since no practical purpose can be served thus except on irrigated land. These vast stretches, then, will be the habitat of the hardy pronghorn who faces unflinchingly the intensive heat of summer or the penetrating cold of winter, the inevitable accompaniment of this choice of range. That the distribution of pronghorns is general in the above mentioned area is established by the fact that eleven Western States have held open shooting seasons for this species during the last few years. Oklahoma, Nebraska, and Colorado have some sizable bands which, under management, can be expected to expand; and with their increase additional habitats can be stocked. Washington, has not produced pronghorns in the history of man although it is obvious that the arid portions of the state offer suitable habitat. Kittitas County has become the range of a small band, the result of transplanting a stock of kids collected near the Hart Mountain National Wildlife Refuge in Oregon and raised to a self-sufficient age by the Washington State Game Department before release on the sagebrush plateaus near Ellensburg, Washington.

In this sweeping western territory small herds are the rule rather than the exception, although in a few places habitat conditions encourage larger herds. In California, Modoc and Lassen Counties have been the most productive. Washoe and Humboldt in Nevada are likewise the range of great numbers. In Montana, Carter County supports a herd which works its way into South Dakota, where Harding and Butte Counties are well stocked at present. The great acre-

ages in Texas leave room for innumerable small groups, and in this state Hudspeth, Culberson, Harteley, Oldham, Brewster, Jeff Davis, and Presidio Counties all provide range for this most interesting game species. Transplantings of trapped pronghorns have proved ineffective on sheep ranges of the arid lands of Texas where keen food competition exists. In Wyoming, Campbell County is well stocked, and in Colorado, these animals can be found in both Lincoln and Weld Counties. In Oregon, Lake, Harney, and Malheur Counties carry scattered herds, some of extremely large size, near the desert lakes and waterholes.

Though the history of pronghorn trends is not complete, we do find data from states where the species has persisted. In spite of the error in these figures resulting from differences in methods of estimating among the several states, these records do prove that these populations can be sustained if carefully handled.

Comparison of the Estimated Numbers of Antelope in Seven States in 1922-24, in 1937 and in 1941¹

<i>State</i>	<i>1922-24</i>	<i>1937</i>	<i>1941</i>
California	1,057	12,829	15,256
Idaho	1,485	11,867	17,160
Montana	3,027	10,602	23,537
Nevada	4,253	12,700	21,455
New Mexico	1,682	15,022	30,335
Oregon	2,039	18,484	26,500
Wyoming	6,977	24,386	24,057

¹Jackson, Hartley H. T.

1944. Big game resources of the United States 1937-1942. U. S. Department of the Interior, Fish and Wildlife Service Research Report No. 8.

Although the trapping and redistribution of adult antelope appears to be the most economical and effective way of starting new herds, there may be occasions when the hand-raising of newly dropped kids has particular advantages. It has been noticeable in this practice that the resulting animals are not as adaptable for restocking purposes on open ranges

as the trapped animals, because of their acquired trustfulness and a lack of timidity and interest in self-defense. A change in the method of handling young may reduce their inclination toward domesticity. The use of such stock on sanctuaries or refuges where adequate protection can be offered will undoubtedly be most effective in a program where knowledge of intimate details of the animals' adjustment may be an effective aid to re-establishing the species on long-vacant habitat. A liberation of transplanted wild stock under these conditions may solve the question of establishment there, but may add little to the science of game management, as close observation of their habits may be impossible, owing to their wildness.

With good management strongly supported by a tolerant and understanding public, the present pronghorn herds can be expanded to an even better distribution. In this management it is essential to rely on small groups rather than extensive herds. When harvests are timely it is imperative that they be conducted under the strictest supervision so that these herds are not wiped out. Under this policy, survival will be assured and a greater amount of enjoyment will be afforded more people. Such a program will require more attention than the species has been given in the decades past, but under the present economy the goal is a possible one.





5

How To Hunt Antelope

DURING THE PAST SEVEN ANNUAL ANTELOPE SEASONS IN Oregon, there has been a tendency to increase shooting distances; and it is now common for shots to be fired at a distance of about 600 yards or more. As most of these shots are taken at running antelope, the chance of accurately placing a bullet in a vital spot is very light. For this reason many hunters carry long-range weapons and unlimited supplies of ammunition. In 1939, one hunter interviewed in the field had shot 91 rounds of ammunition, and still had not procured an animal. He had made no effort to stalk antelope but was taking long shots at moving animals. It is reported in "Hunting Practices," of the *Pittman-Robertson Quarterly*:

"A 1942 antelope hunt in northern Arizona showed that an average of slightly more than 5 shots per bagged antelope were taken. Three hunters reported shooting 30 times; 100 confessed to shooting sixty times with still no hits."

This is a general practice in every state where antelope hunting is permitted. When the skill of hunters is improved, as it must be, the incidental wounding of animals will be greatly reduced.

The common practice of some hunters to shoot indiscriminately at running animals adds little to sportsmanship and often causes controversies among hunters over possession of carcasses. Proof of the right to possess game is often impos-

sible when hunters shoot wildly at the same animals. Few species of similar size can withstand a vital shot so well. Animals shot in the heart have been known to dash off in full flight, to die a half a mile or so distant, while still running on apparently steady legs. A skilled hunter will follow every move of the animal after shooting at it. Many animals have been wasted when this procedure was not followed.

Suitable Ranges for Effective Shots

The average shot should be taken from a distance of not more than 200 yards, unless a gun with special sights be used, as the average gun and sight are inaccurate at a longer range. Since the animal is a small target at the usual shooting distance on the western range, the telescopic sight is desirable when properly used. It is sometimes misused by hunters who attempt shots which overtax their skill and the range of the rifle. This causes many animals to be crippled.

Guns should be given some consideration in this connection. Since a whole volume on the subject would not meet individual ideas, only a few of the basic needs will be mentioned.

For stalking, the gun should not be excessively heavy or long. For shocking power, guns with at least 1,700 foot-pounds muzzle energy are recommended. In the management of a species so limited in numbers as the pronghorn, the bagging of the allowable crop must be carefully restricted. It may be argued that guns of almost any size, skillfully handled, will be adequate, but since experiences to date reveal a general lack of skill or restraint, liberalizations can only result in wastage.

There have been several hunts during which participants have been restricted to one shell fired at a single antelope at a time. These have been called "One Shot Hunts." In a recent Wyoming hunt based on such a plan, some of the contestants failed to bag a pronghorn even after several tries. The normal hunting practice is not so fair to the hunted

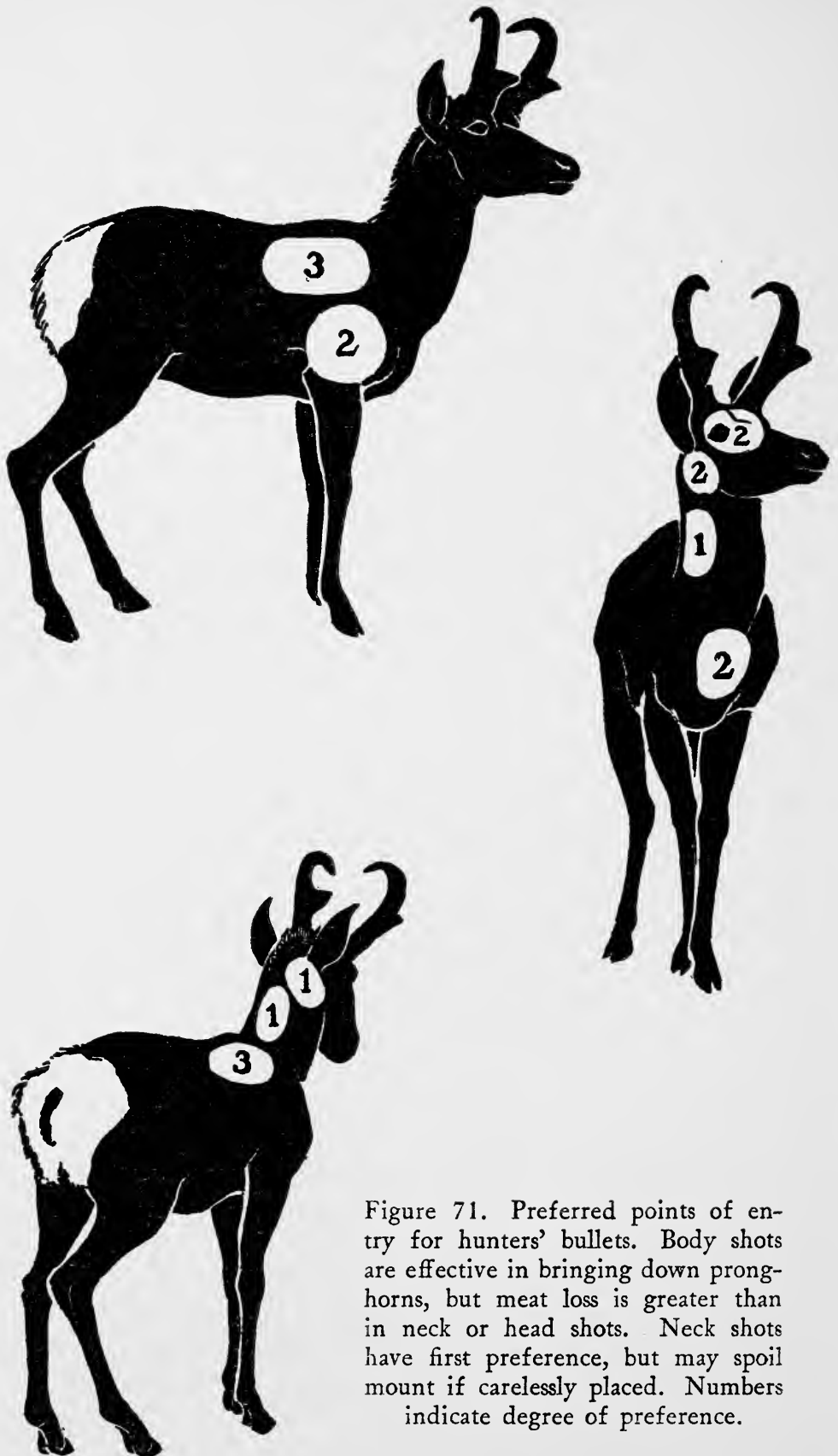


Figure 71. Preferred points of entry for hunters' bullets. Body shots are effective in bringing down pronghorns, but meat loss is greater than in neck or head shots. Neck shots have first preference, but may spoil mount if carelessly placed. Numbers indicate degree of preference.

species since most gunners choose automatic or repeating rifles and fire many times if there is even a chance of a hit. As hunting practices become more refined, a day may come when a 3-shot rifle of adequate shocking power will be offered for common use on pronghorns or other trophy animals. It will be welcomed by those whose task is to stabilize herds.

In the Oregon hunt in 1938 telescopic sights were prohibited. It was feared that their use would encourage "out-of-range" shots. The use of the telescopic sights in recent years has proved its effectiveness in skillful hands but it must be admitted that there is a general tendency to take long shots at pronghorns when there are no sex restrictions.

Bullets most effective in bringing down a pronghorn are the soft nosed or metal patched types. Availability of steel bullets and surplus army carbines will stir arguments of justifiable use which should be met with firmness. They have proved wasteful of game in thorough tests. Even the 50-pound roe-bucks of Europe escaped to die later when shot with military weapons, a regrettable waste.

In Oregon, observed loss by crippling and delayed death has averaged about 20 per cent of the total number of antelope killed each season. The unmeasured loss must be considerable. Most of these animals were injured by bullets fired at such a long range that their effect was not noticed by the hunter. This loss would be even greater if injured or downed animals were not salvaged by other hunters. This they often do if they come across them in time. Since deterioration begins within a few hours after their death, and advances rapidly, few of these crippled animals can be salvaged by the small number of fieldmen assigned to the area. If all hunters are instructed at the beginning of the season to watch for injured specimens, many can be recovered, as their white underbody makes them visible for several miles, if they fall in open country.

How to Distinguish Between Sexes

The general knowledge, skill and understanding which most hunters bring to their sport is quite inadequate to conform to the best management practices. The program of game rehabilitation and restoration of depleted ranges could be more quickly effected if this were not true. It has been especially apparent in antelope hunting. Few hunters are able to distinguish between sexes, simply because they have made no attempt to learn to do so. For this reason, open seasons in the past in Oregon have included the privilege of taking both bucks and does. This has resulted in shooting all age classes, since kids of the year are not always distinguishable by size from the smaller does of the previous seasons. To the game manager this appears to be a ruthless and unnecessary procedure. The shooting of both sexes is advisable only when reduction in populations is desirable. Killing of both sexes and all age classes can only result in rapid decimation of the herds; and a long protective period must then follow to restore abundance. Kids of the year should never be hunted, for they fall too easily a prey to the gunner and need more maturity to become a worthy trophy.

It is obvious that antelope bucks and does are actually very dissimilar. The buck's ears commonly turn sharply inward at the tip; the doe's do not. The black mask on the buck covers his face up to his horns (Figure 65). The doe's nose is very black, but only a faint shading of darker hairs extend upward onto her face. As shown in Figures 66 and 68, the buck carries a black neck patch, visible at long distances. The doe has no such mark. The doe has a much longer and thinner muzzle, and when running holds her head at an angle differently from the buck's. He runs with his horns forward and his nose pointing to the ground, while she points her nose well toward the front. To be sure when these animals are a half mile or more away they can not be distinguished from each other by a novice, but this is beyond the best shooting range and attempts to kill at such distances are wasteful.

Stalking the Buck

The best trophy animals are seldom found with the large herds. (Table 14.) These are, naturally, the mature bucks, which are more solitary in habit except during or shortly before the rutting season. Good specimens often occur in areas where the water supply is very limited or even lacking (always conceding, of course, the hunters' axiom: "Trophies are where you find them"). These bucks walk about very little, are seldom prodded into nervous action, and take on weight. The horns are also in good condition, since solitary bucks are not playing or fighting with others of their kind, and well-matched sets of horns can more often be found. In the seasons open in late September, it was found that among the breeding bucks, about 90 per cent of the horns were marred.

From the standpoint of skill, hunting these solitary animals affords the best sport since the hunter can decide upon some program of approach with little interference from other human beings or antelope. Naturally, he must pit his wits against the superior observational powers of the mature bucks. An old buck will know every inch of his habitat as well as the hunter knows his own home. His ability to stay beyond effective shooting range necessitates expert stalking. To analyze the location of the quarry and then approach so as to kill him with one bullet, without marring trophy qualities or meat, calls for the highest type of sportsmanship.

The 1942 antelope season in Oregon lasted only 2 days, owing to a special closure necessitated by fire hazards and wartime restrictions. One of the finest trophy heads ever recorded was taken during that time. Eugene C. Starr, an avid pronghorn hunter, shot the animal on lower Guano Creek, Lake County, on October 24, 1942.

Measurements made by the author appear to place this head second in rank of trophy antelope of the United States (Table 14).

Starr followed this beautiful animal over the desert range

TABLE 14.

Recent Trophy Pronghorn Records From Oregon¹

Length of Outside Curve		Circumference at Base		Greatest Spread		Tip to Tip	Length of Prong		Locality Killed	Date Killed	Killed by
R.	L.	R.	L.	R.	L.	R.	L.	R.			
19 $\frac{1}{8}$	19 $\frac{3}{4}$	7	6 $\frac{3}{4}$	13 $\frac{1}{8}$	7 $\frac{1}{8}$	5 $\frac{1}{16}$	4 $\frac{1}{16}$		Guano Creek	10/24/42	Eugene C. Starr
16 $\frac{5}{8}$	16 $\frac{5}{8}$	7	7	11	1 $\frac{1}{4}$	2*			Abert Rim	10/2/41	D. M. Kropf
16	16	7	7	7 $\frac{1}{4}$	3 $\frac{3}{8}$	3			Dry Lake	9/29/41	John L. Jenkins
16	16	5 $\frac{3}{4}$	6	14 $\frac{1}{2}$	8 $\frac{1}{2}$	2			Drake's Flat	10/1/41	Carl Hobley
15 $\frac{1}{2}$	16 $\frac{1}{4}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	16	13 $\frac{1}{2}$	3 $\frac{1}{4}$			Coyote Hills	10/1/41	Wm. B. Johnson
15 $\frac{1}{2}$	16 $\frac{1}{8}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	10 $\frac{1}{4}$	3 $\frac{3}{4}$	2 $\frac{1}{2}$			Drake's Flat	9/28/41	E. R. Smith
15 $\frac{1}{8}$	16	6	6	13 $\frac{3}{4}$	8 $\frac{1}{2}$	**			Coyote Hills	9/30/41	Wm. L. Merritt
15 $\frac{3}{4}$	15 $\frac{3}{4}$	6 $\frac{3}{4}$	6 $\frac{3}{4}$	13 $\frac{3}{4}$	7 $\frac{1}{2}$	2 $\frac{1}{2}$			3 mi. so. Abert Junc.	9/30/41	A. B. Davenport
15 $\frac{1}{2}$	15 $\frac{3}{4}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	12 $\frac{3}{4}$	8 $\frac{1}{2}$	2 $\frac{1}{2}$			Abert Rim	10/2/41	D. L. Hostetler
15 $\frac{1}{2}$	15 $\frac{3}{8}$	6 $\frac{1}{4}$	6 $\frac{1}{2}$	12 $\frac{5}{8}$	9				Lake County	10/3/41	C. Tolman
15 $\frac{1}{4}$	16 $\frac{1}{4}$	5 $\frac{3}{4}$	5 $\frac{3}{4}$	23 $\frac{5}{8}$	12 $\frac{1}{2}$	2 $\frac{1}{4}$	15 $\frac{1}{8}$		Jack Lake	**	Milton C. Sheely
15 $\frac{1}{4}$	15 $\frac{3}{4}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	14 $\frac{1}{2}$	10	2 $\frac{7}{8}$			Drake's Flat	9/28/41	Ivan Farr
15 $\frac{1}{2}$	15 $\frac{1}{4}$	6 $\frac{1}{2}$	6	15 $\frac{3}{4}$	8 $\frac{1}{2}$	2 $\frac{1}{2}$			**	9/29/41	H. A. Campbell
15 $\frac{1}{4}$	15 $\frac{1}{4}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	13 $\frac{3}{4}$	7 $\frac{7}{8}$	2 $\frac{3}{4}$			**	9/31/41	Mrs. Arda Thomas
14 $\frac{1}{2}$	15 $\frac{1}{4}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	12 $\frac{5}{8}$	8 $\frac{3}{4}$	3 $\frac{1}{2}$			Jack Lake	9/29/41	Fred R. Sankey
15 $\frac{1}{8}$	15 $\frac{1}{8}$	5 $\frac{3}{4}$	5 $\frac{3}{4}$	17	13 $\frac{3}{8}$	2 $\frac{1}{4}$			Coyote Hills	9/30/41	Paul Kennel
14 $\frac{5}{8}$	15	6 $\frac{1}{4}$	6 $\frac{3}{8}$	13 $\frac{1}{2}$	8	2 $\frac{5}{8}$			**	10/5/41	P. Thomas
15	14 $\frac{3}{4}$	6	6	10	5 $\frac{1}{2}$	2 $\frac{1}{2}$			Mule Lake	9/30/41	Anderson
14 $\frac{1}{2}$	14 $\frac{3}{4}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	12 $\frac{1}{2}$	7 $\frac{3}{4}$	2			Drake's Flat	9/29/41	Lewis Fisher
14 $\frac{1}{4}$	14 $\frac{3}{8}$	5 $\frac{3}{4}$	6	21 $\frac{1}{2}$	9 $\frac{1}{2}$	2			Abert Rim	9/28/41	Norman D. Price
15	14 $\frac{1}{2}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	10 $\frac{5}{8}$	9 $\frac{1}{2}$	2 $\frac{1}{8}$			Drake's Flat	9/29/41	Clyde Bramlette
14 $\frac{1}{2}$	14 $\frac{1}{2}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	13 $\frac{3}{4}$	7 $\frac{3}{4}$	2 $\frac{1}{2}$			**	10/5/41	J. R. Casebeer
14 $\frac{1}{2}$	14 $\frac{1}{2}$	6 $\frac{1}{4}$	6	13 $\frac{1}{2}$	6 $\frac{7}{8}$	2			Jack Lake	9/29/41	Chas. Lockwood
14	14 $\frac{1}{2}$	**	**	21 $\frac{3}{4}$	14	8			Fitzgerald Ranch	10/29/41	Wesley Noah
14	14 $\frac{1}{2}$	6 $\frac{3}{4}$	6 $\frac{3}{4}$	12 $\frac{3}{4}$	7 $\frac{1}{4}$	2 $\frac{1}{8}$			Mule Lake	9/30/41	Leonard Simons
14 $\frac{1}{8}$	14	6 $\frac{1}{4}$	6 $\frac{1}{8}$	16 $\frac{1}{8}$	11	2 $\frac{3}{8}$			Drake's Flat	10/1/41	Dave Parmenter
14	14	6 $\frac{1}{2}$	6 $\frac{1}{2}$	14 $\frac{3}{8}$	9	2 $\frac{1}{8}$			Mule Lake	9/30/41	Kenneth Fanning

¹All measurements are in inches.

*In cases where only one figure is given, information is lacking as to whether measurement is of right or left prong.

**Information missing.

TABLE 15.

Pronghorn Trophy Records

Antilocapra americana americana and *Antilocapra americana mexicana*.*

Length of Outside Curve		Circumference at Base		Great-est Spread	Tip to Tip	Length of Prong		Locality Killed	Date Killed	Killed by	Owner
R.	L.	R.	L.			R.	L.				
20½	—	7	—	16½	7½	4½	—	Arizona	1899	Wilson Potter	Wilson Potter
19½	19½	7¾	7½	17½	10½	5¾	6¾	Arizona, Antelope Valley	1878	—	Dr. Henry M. Beck
18½	17½	6½	5½	12¾	2½	2½	2¾	Wyoming, Greybull River	1928	George Bratton	George Bratton
17¾	17½	7	6¾	14¾	9	6	5½	Wyoming, Red Desert	1936	Fred Mager	Fred Mager
17¾	17½	6¾	6¾	15¼	7½	4½	3¾	Wyoming, Sweetwater Co.	1937	R. L. Davis	R. L. Davis
17½	—	7½	—	13¾	7½	5½	—	Alberta, Brooks	1913	S. P. Fay	S. P. Fay
17½	17½	7½	6½	17½	11¾	4½	3¾	Idaho, Pahsimera Valley	1936	Elmer Keith	Elmer Keith
15¾	17	6½	7	20¾	17¾	4¾	4¾	—	—	—	Fred Sauter
17	—	—	—	18½	17½	5¼	—	Wyoming	1886	J. G. Millais	Mrs. J. G. Millais
16¾	—	5¾	—	16½	9¾	6¼	—	Mexico Chihuahua	1935	Henry S. Fuller	Henry S. Fuller
16½	16¾	6	—	12¼	4	4¼	—	Mexico, Coahuila	1930	Harry McGuire	Harry McGuire
16½	16¼	6½	7	16¾	—	5¼	5¾	Wyoming	—	—	E. A. Lockwood
16¾	16¼	6½	—	15½	13¼	5½	—	Wyoming, Greybull River	1935	John Jernberg	Thomas A. Yawkey
16¾	—	6½	—	13¼	5¾	4½	—	Montana	—	—	Nat. Coll. Heads & Horns
16¾	16¾	6¼	6¼	14½	9	3½	3¾	Idaho, Pahsimera Valley	1935	Elmer Keith	Elmer Keith
16¼	15¾	6¾	6	18	—	6¼	6¼	Wyoming	—	—	E. A. Lockwood
15½	16¼	6¾	5¾	14	5	3¾	3¾	Texas	—	Maury Kemp	Nat. Coll. Heads & Horns
16¼	15¾	6	6	17½	7	6	5½	Wyoming	—	—	E. A. Lockwood
16¼	15¾	5¾	—	17¾	10¾	4½	—	Colorado, Routt Co.	1891	F. A. Williams	F. A. Williams
16¼	15¾	5¾	5¾	15½	10½	4	4	Alberta, Brooks	1905	James G. Brewster	James G. Brewster

*Prepared from North American Big Game, Boone and Crockett Club, Scribners 1939, page 501.

for the entire day before he came within possible shooting distance. His kill was made with one bullet from a 270-magnum by Neidner, from a knee rest position while the pronghorn was standing. The rifle was equipped with a 2½-power Lyman Alaskan sight. Measured distance for the shot was 510 yards.

The bullet entered low at a point just behind the last rib on the right side, cut upward through the ribs without injuring much meat, and finally lodged in the shoulder. As proof of the great physical strength of the pronghorn, the buck ran 75 yards before it dropped dead. This experience emphasizes the need of guns with great shocking power. It is a typical case.

The Approach

Only on the rarest occasions is it possible to stalk a large antelope herd and select from it a good trophy. If the animals are grouped, they quickly detect human approach, since all are alert to intruders. Although it is believed that the pronghorn's power of scent has been greatly overemphasized, it is obvious that at close range the animal can detect human intrusion. A hasty motion may put the whole band in flight when a cautious step might not be detected. It is often necessary to spend several hours approaching them from the proper angle. Occasionally, in certain terrain, with wind blowing from the animals to the hunter, chances for a good shot may materialize.

It is sometimes necessary on open range to wait until the animals change their position. This is usually a short time, as their restless fidgeting keeps them on the move. Although they may confine themselves to an area a mile square, they may visit all parts of the area during an hour's time.

Pronghorns should always be shot in a standing position, because of the danger of injuring the trophy. Running animals may fall and break their horns, knock off great patches of hair, or bruise their flesh.

Hunting in groups is rarely successful. A single hunter, or two hunting together with one person stalking is preferable. If more than one hunt together, each man should select a specific animal so that no confusion ensues at the time of shooting. This method develops a fine spirit of sportsmanship. Where hunters cannot find concealment and yet watch each others actions, it is more effective for one to stalk his animal alone. His partner can then be particularly helpful in watching the shot and keeping the animal in view after it has been hit. In more than one instance a fatally hit pronghorn has escaped the hunter to be located where he dropped by his partner.

Care of the Carcass

After a pronghorned antelope is killed, bleed quickly by placing on an incline with the head lower than the body. Sever the jugular vein just above the breastbone, or brisket. As soon as the blood has drained, move the carcass to a clean spot, or hang from a tree if any is near. If the head is to be mounted, it should be removed with sufficient neck skin for that purpose. Then sever the legs at the knee joints and remove. Split the animal from the breastbone to lower abdomen. Cut carefully around the vent. Then tie lower end of intestine with a piece of cord, and pull it from between the buttocks into the abdominal cavity, after cutting all connective tissues. If the animal is being dressed on the ground, it may be advisable to remove the digestive organs by cutting the food pipe, or esophagus, and rolling them out. Before doing this, force the food out of a portion of the tube, by drawing between thumb and forefinger; then tie a cord around it in two places an inch apart. Cut between these cords so that no food can taint the flesh. Even if the chest cavity is opened, the lungs and windpipe are usually more easily removed through the abdominal cavity after their attachments are severed. Since the pronghorn has a gall bladder, care must be taken in handling the liver until this has been removed.

The next step is to skin the carcass. If hung, begin at the rump and gradually work forward, taking care that the hair side does not come in contact with the meat. The hairs are loose and are easily spread to the flesh. If the carcass is on the ground, start at the abdominal opening and work both ways, loosening the skin toward the backbone, propping the animal up with stones when necessary, finally rolling it on its side to remove the skin from the back. In accordance with game laws, some obvious sign of sex, such as the scrotum, should be left on the carcass.

In handling game forms, the careless use of the knife or clumsy treatment of the skin is often the foundation for the general belief that glands are responsible for unpleasant flavors. Peculiarly enough, the average sportsman's solution to the problem is quickly to skin the game to overcome taint of the meat. If surface glands were the cause of this tainting, however, removal of the skin would hardly be a solution, since the external duct of the gland would be severed in the skinning process, merely facilitating the spread of the glandular secretions.

Careful cooling of the meat is a further necessity. This can be accomplished quickly by hanging the spread carcass in a cool place. If permitted to hang overnight the meat should be cool enough to wrap for traveling.

The Trophy Scoring System

The sport of the chase has existed in one form or another from the time primitive man tossed a rock at a crouching animal; and still the rules are less sharply defined than in most forms of recreations. Though many sports are of recent origin, the rules and ethics governing them have reached a degree of development that finds no counterpart in the hunt. It is now time to formulate basic rules and regulations to raise this recreation to a higher level of sportsmanship. The old English rule, "to the man who first draws blood belongs the hide and horns and half of the meat" is

not commonly recognized. There are many hunters who shoot sitting game birds, a practice which requires little skill and gives the birds very little chance. Hunters often shoot pheasants in the dusk of early morning before they have left their night roost. There are innumerable instances of interest merely in the quantity of game obtained and apparent pride in the ability to take advantage of game handicaps. The man whose antelope died from a bullet fired point-blank as it lay exhausted in the dust of the desert has been accorded equal honors with the hunter who selected an animal, stalked it, and skillfully brought it to earth.

Often the winning of a sports championship is accompanied by some type of award, perhaps a cup or plaque, in recognition of the skill involved.

Big game hunting can be managed upon the same basis, especially with species like antelope, which is one of the finest of trophy animals. Yet a trophy is useless as a measure of skill without some grading or scoring method. For the past 75 years there has been interest in the scoring of trophies merely from the standpoint of symmetry and size. The spread, length and breadth of horns, or other characters that do not measure skill or sportsmanship, have been the bases of trophy classification.

In 1941, the Oregon Cooperative Unit, working with the Oregon Game Commission, conducted an experiment in Lake County, Oregon, setting aside an area of about half a million acres for the purpose of scoring antelope kills and measuring the prowess of antelope hunters.

In the original conception of the scoring system, two requirements seemed essential. First, a scoring plan based on grading the kill and, second, some special recognition of those, who by their fairness, sportsmanship, and diligence, attained high scores.

To grade antelope kills, a system was prepared with 100 per cent as the perfect score. Based on this figure, deductions were to be made until the lowest possible grade might be a

minus quantity. For example, if an animal was poorly chosen, brought down with a number of bullet wounds, and improperly dressed, the score might be minus 25. A minus score serves to emphasize the need for a poor hunter either to improve his sportsmanship and skill or to withdraw from the sport. This is a challenge to hunters. They should not be resentful if they be eliminated after failing to raise their grade in successive years. To be sure a game department needs proper authority to enforce such a regulation.

With other game animals such an exacting scoring plan could be liberalized, with the essential features retained. In heavy cover, like that inhabited by deer, hunters might be tempted to survey their kill and abandon it on finding that it did not rank high enough in the scoring plan; and then they might try again. On the open antelope ground of Oregon and elsewhere throughout the West, however, where hunting is conducted under the surveillance of many observers, no one would be so likely to do this.

Expert Award			
To			
John Doe			
In recognition of the Highest Marksmanship, Skill, and Carefulness in the selection of a Trophy Animal under the rules of the Oregon State Game Commission			
Trophy Record			
Animal <u>Antelope</u>	Score <u>93</u>	Horns	
Place <u>Catlow Valley</u>	Date <u>Sept. 27, 1941</u>	Length around outside of curve base to tip	
Sex <u>Male</u>	Weight <u>93</u>	Left <u>15"</u>	Right <u>15 1/2"</u>
		Circumference at base of horn	
		Left <u>6"</u>	Right <u>6"</u>
		Spread tip to tip <u>6 1/2"</u>	
		Extreme spread between outside of horns <u>13 3/4"</u>	
		Placing of Bullets	
		No. <u>1</u> Location <u>Neck, Back of ear</u>	
		Oregon State Game Commission	
		John Jones Commissioner	
		Richard Roe Supervisor	
	Date <u>Dec. 5, 1941</u>		

Figure 72. Trophy award used in Oregon in recognition of pronghorn hunting skill.

To test this plan, trained field workers were assigned to three checking stations. Those holding antelope hunting permits were required to register at checking stations in the usual manner before they were allowed to enter the area. At this time they were furnished complete information on the

TABLE 16.

Score Chart

Date	Checking Sta. No.	Checker.....
License No.	Permit No.	
Hunter's Name		
Address		
		Locality Map Score Column
1. Care of carcass		
Properly skinned and dressed		
Properly cooled		
2. *Placing of bullets		
(a) One only		
Neck, back of ears		
Head, heart or shoulders		
Backbone, forequarters		
(b) Two bullets or more—No. of bullets.....		
Neck, back of ears		
Head, heart or shoulders		
Backbone, forequarters		
3. *Paunch or rear quarter shot		
Posterior to thorax. Broken leg.		
Right. Left. Marred hoof or hoofs. Right.		
Left. Marred horn. Right or left.		
4. Horns		
Length around outside curve, base to tip.		
L R		
Circ. of base L R		
Spread tip to tip Extreme spread		
Length of prong		
Sex	Wt.....	Total Score
How dressed		
Condition		Total Deductions
		FINAL SCORE/

*Underscore shots as found on carcass

/Expert Certificate awarded for grades over 79 per cent

TABLE 17.

A Grading System for Scoring Antelope Kills

1. Care of the carcass:		
Properly skinned and dressed	25%	
Properly cooled, sweet smelling	25%	
Total possible grade for perfect care	50%	perfect
2. Placing of bullets in relation to antelope anatomy:		
(a) One only—in neck or back of ears, not injuring head for mount	25%	"
One only—head, heart or shoulder	20%	"
One only—backbone in forequarters	15%	"
Two bullets or more:		
Value—one-fourth of perfect grade for one bullet in similar anatomical location.		
Paunch, or rear quarter shot, posterior to thorax, broken legs, marring of hoofs or horns by bullets—deduction from total grade for each shot	—15%	
(b) Horns—Even, typical (not freakish) and symmetrical. Over 11 inches from base to tip, measured over outside curve. One point deducted for each inch less than 11 inches until 8 inches is reached. Then 2 points for each inch less is deducted. Lack of symmetry, deduct 3 points. Each horn measured separately (12½% is a perfect score).	25%	perfect
(c) For shooting immature or female antelope.	—15%	

purpose of the plan and the regulations in effect on the experimental tract. Upon leaving the hunting grounds they were required to check out, giving the details of the hunt and submitting the animal for inspection. The checker graded the kill, totaled the scoring chart, and the Oregon State Game Commission later awarded certificates to those meeting the required qualifications.

Table 18 shows that there is a vast opportunity for improvement in hunting skill. Only 35 per cent of the kills could be classified as trophy animals. Since 51 per cent were composed of immature bucks and does, most of them less than 6 months of age, game selection was obviously not attempted.

TABLE 18.

Antelope Scoring Program Records

Lake County Stations
Oregon, 1941

Average number shots per animal bagged (hits).....	1.6
Adult bucks taken as trophies.....	35 %
Immature bucks, does and adult does classified as to age class....	65 %
Immature bucks 27%	
Immature does 24%	
Mature does 14%	
Average score	35.6
Average men's score	38.2
Average women's score	8.0
Score classes:	
100 to 80 (Expert Award)	22.7%
79 to 60	13.9%
59 to 30	18.3%
29 to 0	25.8%
-1 to -30	13.9%
-30 to -60	5.4%

Although, in the seasons which followed, the grading system could not be applied owing to lack of sufficient manpower, it was noticed that many of those who received the lowest or minus scores on their 1941 kills did not return to hunt. During the same period the number of buck antelope of trophy caliber taken gradually increased. Although there was no publicity of the scoring records of individual hunters, it is believed that publication of such records would encourage self-improvement among hunters.

In the scoring plan a penalty was placed on the hunter who took an immature or female antelope. This is in accord with the management theory that the killing of females is not conducive to increasing abundance. It is significant that since then hunters have seemed more efficient in distinguishing between sexes, and accomplishment which was considered almost impossible in the early days of the open season.

To give due recognition to skill, a certificate was designed. This was inscribed on parchment-type paper, carrying in

detail descriptive data relative to the kill (Figure 72). These certificates were received and valued as mementos of the hunt. The first tangible proof of this came in numerous letters from those who had received an award, expressing their appreciation. In the succeeding years, several reported the loss or destruction of their certificates and asked to have them replaced. In several instances, hunters awarded the certificate received publicity in their home-town newspapers.

Only four hunters made a perfect score of 100 in 1941. It was obvious when these trophies came into the checking station that they were in perfect condition and perfectly dressed. There was so much difference between these animals and the average specimen checked out that it has occurred to Research Unit workers that a pre-season educational program to teach hunters to care for their trophies might be desirable. Next, the enthusiasm of those participating in the experiment was general. The rigid rules seemed to develop the best sporting qualities, as well as providing some excellent trophies. Interest was keen enough to make it appear feasible to continue the plan in the future with hope for considerable improvement in hunting skill.

EPILOGUE

An Allegorical Reverie

The late September sun beats down on the high desert in a losing bout with the north wind, the envoy of winter. On a sun-bathed slope, venerable Cha-oo, pronghorn patriarch of the basin where once the restless surf swept the shores of this inland sea, focuses his eyes on the distance. He looks into the past and is still. Through a notch on the horizon a group of lithe horsemen are silhouetted like centaurs against the cumulus clouds. The sea floor, long dry, marks their passage with wavering curtains of ashen dust as they describe the usual diminishing circle of an Indian surround—the bane of his kind. Like the fingers of aurora borealis, a desert mirage blots out discernment and with unfilmed eyes Cha-oo peers into blue haze.

He looks more intently as the fantasy reappears. The redmen are replaced by buckskin-shirted emigrants with their long rifles. They draw nearer. Now must he learn that escape between the hunters is harder than before, as he sees his kind dodge and turn to outdistance the angry spurts of alkali dust, raised at the “boom” of the long rifles.

A breath of sage-perfumed desert air hurries o’er the hill. It refreshes his body and his muscles flex in ecstasy. Following in its fragrant path a small knee-high funnel of dust pauses quivering and blooms into a magician’s bouquet of whirling chaff, grass and tumble weeds. Cha-oo turns his magnificent head for a moment, and Time sets a new stage.

Across the long dead sea, ribbons of white lie in purposeless pattern, and on them in the distance, flashing beetles move in scurrying haste, growing to Gargantuan size as they draw nearer. They come not alone, but by tens, twenties,—

numberless hordes each disgorging its quota of shooters. The patriarch sniffs the air. No more is there a smell of earth, and the things earthy. No more a uniformity of pattern for his senses to appraise. But in their stead, the mark of new trades and skills, the pungent but unexplainable smells of a mankind long since divorced from nature, and yet ever wooing, as the season of the harvest returns.

Cha-oo is immobile. He watches the frenzy among his mates as they crowd together in mutual fear. The "many-shooting" guns beat a staccato on the rimrock. There is confusion and noise and hurry. In the distance this mad revel is finally blotted out by the first soft curtain of the desert night.

The old buck springs knifelike to his feet. Against a Remington sky he stands, a statue of grace and beauty. His body is lithe, his senses keen, his spirit unbroken. He is content in his habitat. The shingle rattles behind him, but he is inattentive. Then a scent strikes his nostrils and at once he is alert. Man comes! But it is not an ordinary man. He has the scent of the out-of-doors. His step is of confidence. He is not in haste and has a manner of understanding. He, too, seems a part of the desert. For a moment their eyes meet. It is a gaze of intimate appraisal. Though the light is waning the study is not hurried. They have a common bond. Cha-oo and the hunter await the morrow.



TOMORROW

*Tomorrow may the dawning light
Bring to this plain, one such as he
Who tramps the sage with keen delight,
Within whose heart a fairness be.*

*Send one who knows the desert wide
The warp and pattern of our ways
Who seeks to turn the ebbing tide
On twilight haze of yesterdays.*

*And coming may he be alone
To stalk, to hunt, to drink his fill
Of this, the cup of Nature's own
And test my speed against his skill.*

*Until the end, may it be well
That "hunter" and the "hunted" stray
Not far apart in love of chase
Eternal be this dawning day.*

*Tomorrow! Bring the hunter skilled
But long divorced from selfish greed
Who measures not the trophies killed
Whose love of earth is love indeed.*

ARTHUR S. EINARSEN.

Appendix

Acknowledgments

BECAUSE OF ITS NATURE THIS WORK HAS EXTENDED OVER a long period. In these years many helpful and understanding friendships have developed, and from such associations a fund of information was accumulated.

Among these who graciously contributed are the late Oliver Jacobs, a pioneer of the sagelands, from whose vivid memory and capacity for observation much of the history has been reconstructed; Eugene C. Starr, Fred Sankey, Milton C. Sheely, and George B. Cox, ingrained antelope hunters wise in their ways and maintaining the highest skill in this sport; Rowe Davis of Burns, Oregon, pioneer in the use of the airplane on pronghorn range both for surveys and coyote control; the Tudor family, whose ranch is located on Crooked Creek, near Rome, Oregon, in the center of pronghorn range; Dr. E. L. Packard, Dean and Director of General Research and Professor of Geology at Oregon State College, whose help on prehistoric data was unstinted; and many others who offered assistance in various ways.

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Part of the routine work was done by field assistants, or graduate assistants on a Research Unit Fellowship. Practical application of field techniques and education is an integral part of the Research Unit policy for training under this plan. A. V. Myers was assigned to range survey, distribution and general observation. Albert Antrei made plant studies and sketches of pronghorns. The late Lieutenant Keith Kershaw, as well as Louis Bowen, Lee Wallace Kuhn and Cecil Gubser, all helped periodically in collecting data at checking stations; Michael Throckmorton covered the entire Oregon prong-

horn range during the summer of 1944 to determine herd distribution and abundance. A final reconnaissance of Oregon pronghorn range by airplane, by car and afoot was made in September 1944. John W. McKean, Coordinator of Big Game Management for the Oregon State Game Department aided the author in the aerial surveys.

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A Short Sketch of the 1945 Restricted Pronghorn Season in Oregon¹

The rapid decline of pronghorns in Oregon resulted in regulations in 1913 which prohibited further kill. A quarter of a century later, they had again become abundant on some ranges, and in 1938 a harvest was decided upon. This first season after a long closure was an experimental one. Permits were limited to Lake, Harney, and Malheur Counties. Each person could request a permit for anyone of these several counties. In the succeeding years until 1945, there was an annual open season with kills limited to one animal of either sex. Each year field workers opposed this regulation, maintaining that the distribution of pronghorns to all ranges had

¹The study which is the basis of this monograph began in 1936 and was essentially ended with the beginning of preparation of the manuscript in 1944. The harvest of pronghorns in Oregon followed a uniform pattern in the years of open season, 1938-1944 inclusive. All age classes and both sexes were shot. Research early divulged the need for restricting the kill to bucks only if stabilized abundance was to be maintained. This correction did not occur until the 1945 harvest. To bring management history up to date this short summary of the 1945 season has been added to the appendix.

not been accomplished and that in many areas desired levels of abundance could not be maintained if female pronghorns were taken. The hunters, on the other hand, demanded the privilege of killing one of either sex on the grounds that sex determination was too difficult on the desert ranges and insisted that either gross violation of the regulation or mediocre sport would result. This has had a drastic limiting effect upon the herds of Oregon, since in the recorded kill of about 5,139 animals during the 7 years, fully 40 per cent were does. The combined effect of human beings and nature was obvious to the field workers, and each year a determined stand was taken to correct the practice of taking does at least until the conditions changed for the better in kid survival. During the open seasons hunters were tempted to shoot longer ranges each year. This resulted in more crippled animals. In 1944, 600-yard ranges were common. It is obvious that at such distances sex could not be determined by usual means nor could well-placed shots be made.

A correction of this liberal regulation was made in 1945, when kills were limited to antelope with ear length horns. And when the season opened at sunrise on September 22, an adequate patrol was on hand to support this new restriction. A well-organized staff of the Big Game Division of the Oregon State Game Department and the Game Patrol Division of the Oregon State Police offered such good range coverage that almost every kill was checked within a few moments after it occurred. Instead of the usual patter of many doe kills, only three definite cases came to the attention of the observers during this period. The hunt was very successful and over 50 per cent of the 850 permits issued were attached to kills. This is a high success ratio since about 200 who were issued permits did not appear on the hunting grounds.

There were relatively few crippling losses, and the trophies brought in were in much finer condition since they had been carefully selected. By this step alone many does were saved to bolster the waning population. By the highly-

organized method of patrol worked out by the Oregon State Big Game Division, the carnage common to this hunting area in the years past disappeared, and the shooting gallery technique applied to this sport changed in one season to that of individual skill and sportsmanship.

One of the features of the patrol was the use of a small, low-speed plane equipped with a radiophone so that direct communication with ground crews could be maintained. It was especially useful in scanning the range for fallen animals, and discreetly used, can be a practical adjunct to surveillance of these wide ranges. It is suggested, however, that on hunting grounds where herds are being stalked, the plane should be kept at a distance and not fly at an elevation lower than 1,000 feet. Since much of this country was used as an aerial gunnery range for the navy several years before this hunt, pronghorns were timid of the planes, even though aerial practice was limited by regulation from gun to tow target only.

This recent hunt provides evidence that an orderly harvest can be most productive of sport in spite of the restriction of kill to buck antelope only. A high percentage of kill resulted and with much more satisfaction to the individual than by previous methods. Those who are wishfully inclined and seek only some shooting will find that as years go on, they must confine their activities to artificial targets, leaving the game to hunters who obtain much of their enjoyment from the trip, their associations, the prairies wilderness and the other attributes of the out-of-doors.

Systematic Descriptions¹

***ANTILOCAPRA AMERICANA AMERICANA* Ord²**

American Antelope; Pronghorn; Tah-ah-nah of the Taos Indians

Antelope americanus Ord, *Guthrie's Geography*, Amer. ed. 2, v. 2, p. 292, 1815.

Type locality.—Plains and highlands of the Missouri River.

General characters.—Size of a small deer, horns of male erect, with recurved tip and flat prong in front; deciduous annually. General color, buff with white rump and lower parts, and black markings on neck and face.

Measurements.—Adult male from North Dakota: Total length, 1,320; tail, 110; foot, 400 millimeters.

***ANTILOCAPRA AMERICANA OREGONA* Bailey³**

Oregon Pronghorn; Prong-horned Antelope; Prongbuck; American Antelope; Te-Na of the Piute; Cha-o of the Klamath.

Ontilocapra americana oregona Bailey, *Biol. Soc. Wash. Proc.* 45: 45-46, 1932.

Type.—From Hart Mountain (Mount Warner), Oreg., collected by Luther J. Goldman, September 22, 1914.

¹This manuscript has been prepared as an aid to the management of the North American pronghorn. In this approach it seems logical to emphasize the history, facts of life, distribution, dangers and management of the species. No taxonomic study has been attempted and resort to Bailey and other sources for systematic descriptions has been made for the appendix so that those interested in this specific knowledge may have their needs at least partially met. The description of the Oregon subspecies is given prominence because of its place in this work.

²Description adapted from Vernon Bailey, *Mammals of Mexico*, North American Fauna, No. 53, December, 1931. Page 22.

³*North American Fauna*, No. 55, *The Mammals and Life Zones of Oregon*, June 1936. Page 70.

General Characters.—The pronghorn is about the size of a small deer, very slender, graceful, and swift; horns deciduous, flat, each with one flattened prong and recurved tip; hoofs simple; no dewclaws; tail short; colors cinnamon buff with strongly contrasted black-and-white markings on head and neck; a rump patch of white is spread at will into a great white rosette or closed down, is small and inconspicuous. Young similar in color to adults with white of sides and rump at first obscured. It is neither a true antelope nor a goat, but belongs to a family of one-pronged deciduous-horned animals, including one species and several geographic subspecies peculiar to North America.

The Oregon specimens represent a fairly well marked form distinguished as follows: Size about as in *Antilocapra americana*, or slightly larger, with relatively larger feet, longer horns, slightly paler coloration, less black about face and mane, and less white on crown and shoulder stripes. Color of body bright cinnamon brown, becoming dark tawny on mane and pale cinnamon on legs and ears; muzzle, eyelashes, spots over anterior corner of eyes, edges of ear tips, and in males spot at angle of jaw, black or blackish; forehead dark grayish cinnamon; crown and nape dull gray or dark cinnamon without conspicuous white markings.

Skull.—Similar to that of *americana* with slightly larger, more rounded audital bullae. Horns in type specimen very long, slender, and wide-spreading, but in another buck from the type locality about as in average *americana*. In a large old male from the Carnegie Museum, collected at Hart Mountain, Oregon, September 11, 1927, by O. F. Fuehrer, the horns are very long and broad with moderately heavy basal and lateral knobs or tubercles, less extremely developed than in *peninsulae* from Baja, California, but much more so than in typical *americana* or *mexicana*.

Measurements.—Of type: Total length, 1,473 mm; tail, 90 (measured dry); hind foot, 431; ear from crown, 155 (measured dry). Skull: Basal length, 240; nasals, 94;

alveolar length of upper molar series, 70; interorbital width, 109; outer orbital width, 140; occipital width, 84; horns from base over curve, 379 and 355 (tip gone); spread of tips, 400. Hoofs: Hind hoof, base to tip, 63; height of front edge, 40; width of one heel, 17; of both heels, 37. Front foot, base to tip, 66; height of front edge, 41; width of one heel, 25; of both heels, 52.

Specimens examined from Oregon.—Six from Hart Mountain east of Warner Lake, and a skull from Adel, near the south end of Warner Lake.

***ANTILOCAPRA AMERICANA MEXICANA* Merriam¹**

Mexican Antelope: Mexican Pronghorn

Antilocapra americana mexicana Merriam, *Biol. Soc. Wash. Proc.* 14: 31, 1901

Type.—Collected in Sierra en Media, Chihuahua, Mexico (about 10 miles south of the New Mexico border), October 4, 1899, by E. W. Nelson and E. A. Goldman.

General characters.—Colors paler than in *americana*; showing slight cranial differences.

Measurements.—Type (young adult male): Total length, 1,420; tail, 145; hind foot, 410 millimeters.

***ANTILOCAPRA AMERICANA PENINSULARIS* Nelson²**

Antelope of Lower California

Antilocapra americana peninsularis subsp. nov.

Type.—No. 178,445, adult male, U. S. National Museum, Biological Survey Collection, from 45 miles south of Calmalli, Lower California, Mexico; collected February 4, 1912, by E. W. Funcke.

Distribution.—Middle Lower California, south to the head of Ballenas Bay in about 27° north latitude, and north

¹Description adapted from Bailey, *Mammals of New Mexico. North American Fauna*, No. 53, November, 1929. Page 27.

²*Proceedings of the Biological Society of Washington*, Vol. XXV, pp. 107-108, June 29, 1912.

on the west coast to about $29^{\circ}30'$; on the gulf side to beyond 32° , to the southern end of the Colorado Desert.

Subspecific characters.—Compared with typical *Antilocapra americana* from North Dakota this form agrees in the dark sooty-brown facial markings strongly contrasting with the surrounding white and dark reddish-buff areas (facial area distinctly paler in *mexicana*); ears of *peninsularis* much darker about tips; in typical *americana* as well as in *mexicana*, terminal half of ears bordered with a narrow black line and a few scattered black hairs on outside (back), in *peninsularis* this black border much heavier and terminal third of outside (or back) mainly blackish, the terminal inch commonly nearly pure black; in *americana* rufous area on top of tail extends forward partly dividing white rump patch but usually becoming obsolescent before reaching rufous area on back; in *peninsularis* this rufous band extends forward forming a strongly marked bar about an inch wide from tail to rufous of back thus definitely dividing white rump patch; horns of *peninsularis* shorter and actually as well as proportionately thicker laterally at base than in *americana* or *mexicana*, with the surface, up to prongs, much roughened and covered with numerous small knobs and wartlike protuberances; horns in this form also average much more upright and less diverging than either of the other forms; molar series heavier than in *americana* and much heavier than in *mexicana*. Size about the same in all three subspecies.

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